DEPARTMENT OF MECHANICAL ENGINEERING
INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING
INDUS UNIVERSITY

B TECH MECHANICAL ENGINEERING SEMESTER –III TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	**CODE**	**SUBJECTS**	**TEACHING SCHEME**			**CREDITS**	**HOURS**	**EXAMINATION SCHEME**					
								THEORY			**PRACT**		**TOTAL**
								CIE					
			L	**T**	**P**			**MID**	**IE**	**ESE**	**CIE**	**ESE**	
1	SH0301	Differential Equations and Integral Transforms	03	02	00	04	30	30	10	60	00	00	100
2	ME0301	Kinematics of Machines	03	02	00	04	30	30	10	60	00	00	100
3	ME0302	Fluid Mechanics	03	00	02	04	30	30	10	60	40	60	200
4	ME0303	Strength of Materials	03	02	02	05	30	30	10	60	40	60	200
5	ME0304	Material Science and Metallurgy	03	00	02	04	30	30	10	60	40	60	200
6	ME0305	Measurement Techniques and Instrumentation	03	00	02	04	30	30	10	60	40	60	200
7	SH0307	Human Values and Professional Ethics	01	00	00	00	00	00	00	00	00	00	100
TOTAL			**19**	**06**	**08**	**25**	**180**	**25**	**60**	**360**	**160**	**240**	**1100**

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B TECH MECHANICAL ENGINEERING SEMESTER –IV TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	**CODE**	**SUBJECTS**	**TEACHING SCHEME**			**CREDITS**	**HOURS**	**EXAMINATION SCHEME**					
								THEORY			**PRACT**		**TOTAL**
								CIE					
			L	**T**	**P**			**MID**	**IE**	**ESE**	**CIE**	**ESE**	
1	SH0401	Complex Analysis and Numerical Methods	3	2	0	4	5	30	10	60	00	00	100
2	ME0401	Engineering Thermodynamics	3	2	0	4	5	30	10	60	00	00	100
3	ME0402	Manufacturing Processes	4	0	2	5	6	30	10	60	40	60	200
4	ME0403	Dynamics of Machines	3	2	2	5	7	30	10	60	40	60	200
5	ME0404	Fluid Power Engineering	4	0	2	5	6	30	10	60	40	60	200
6	ME0405	Machine Drawing	1	2	0	2	3	30	10	60	00	00	100
7	CE0407	Cyber Security and IPR	1	0	0	0	1	00	00	00	00	00	100
TOTAL			**19**	**8**	**6**	**25**	**33**	**180**	**60**	**360**	**120**	**180**	**1000**

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B TECH MECHANICAL ENGINEERING SEMESTER –V TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	**CODE**	**SUBJECTS**	**TEACHING SCHEME**			**CREDITS**	**HOURS**	**EXAMINATION SCHEME**					
								THEORY			**PRACT**		**TOTAL**
								CIE					
			L	**T**	**P**			**MID**	**IE**	**ESE**	**CIE**	**ESE**	
1	ME0501	Heat and Mass Transfer	03	02	02	05	07	30	10	60	40	60	200
2	ME0502	Computer Aided Design and Analysis	04	00	02	05	06	30	10	60	40	60	200
3	ME0503	Design of Machine Elements	03	02	00	04	05	30	10	60	00	00	100
4	ME0504	Machining Processes	03	00	02	04	05	30	10	60	40	60	200
5	ME0505	Industrial Engineering	03	00	00	03	03	30	10	60	00	00	100
6	ME0506	Automobile Systems	03	00	02	04	05	30	10	60	40	60	200
7	SH0507	Technical Communication and Soft Skill	01	00	00	00	01	00	00	00	00	00	100
TOTAL			**20**	**04**	**08**	**25**	**32**	**180**	**60**	**360**	**160**	**240**	**1100**

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B TECH MECHANICAL ENGINEERING SEMESTER –VI TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017														
SR NO	**CODE**	**SUBJECTS**	**TEACHING SCHEME**			**CREDITS**	**HOURS**	**EXAMINATION SCHEME**						
								THEORY			**PRACT**		**TOTAL**
								CIE					
			L	**T**	**P**			**MID**	**IE**	**ESE**	**CIE**	**ESE**	
1	ME0601	Operation Research	03	02	00	04	05	30	10	60	00	00	100
2	ME0602	Machine Design-I	04	02	00	05	06	30	10	60	00	00	100
4	ME0604	Internal Combustion Engine	04	00	02	05	06	30	10	60	40	60	200
5	ME0605	Refrigeration & Air Conditioning	04	00	02	05	06	30	10	60	40	60	200
3	ME0603	Total Quality Management (DE-I)	03	00	00	03	03	30	10	60	00	00	100
6	ME0606	Advanced Mechanics of Solids (DE-I)											
7	ME0614	Surface Engineering (DE-I)											
8	ME0608	Vehicle Dynamics (DE-II)	03	00	00	03	03	30	10	60	00	00	100
9	ME0609	Advanced Thermodynamics And Heat Transfer (DE-II)											
10	ME0610	Alternate Energy Sources (DE-II)											
11	ME0611	Steam And Gas Turbines (DE-II)											
12	ME0612	Advanced Manufacturing Techniques (DE-II)											
13	ME0613	Rapid Prototype & Tooling (DE-II)											
14	ME0607	Finite Element Method (DE-II)											
15	SH0607	Advanced Technical Communication And Soft Skill	01	00	00	00	00	00	00	00	00	00	100
TOTAL			**20**	**04**	**08**	**25**	**30**	**180**	**60**	**360**	**80**	**120**	**900**

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B TECH MECHANICAL ENGINEERING SEMESTER –VII TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	ME0701	Machine Design- II	04	02	00	05	06	30	10	60	00	00	100
2	ME0702	Power Plant Engineering	03	00	00	03	03	30	10	60	00	00	100
3	ME0703	Production Technology	04	00	02	05	06	30	10	60	40	60	200
4	ME0704	Computer Integrated Manufacturing	03	00	02	04	05	30	10	60	40	60	200
5	ME0705	Mechanical Vibrations	02	02	02	04	06	30	10	60	40	60	200
6	ME0706	Advanced Optimization Techniques (DE-III)	03	00	00	03	03	30	10	60	00	00	100
7	ME0707	Design Of Pressure Vessels And Piping (DE-III)											
8	ME0708	Robotics & Artificial Intelligence (DE-III)											
9	ME0709	Energy Conservation & Management (DE-III)											
10	ME0710	Advanced IC Engines (DE-III)											
11	ME0711	Advanced Refrigeration & Air Conditioning (DE-III)											
12	ME0712	Advanced Metrology & Computer Aided Inspection (DE-III)											
13	ME0713	Design For Manufacturing And Assembly (DE-III)											
14	ME0714	Advanced Metal Forming Processes (DE-III)											
15	ME0715	Manufacturing Process Technology I & II (DE-III) (MOOC)											
16	CV0712	Disaster Management	01	00	00	00	01	00	00	00	00	00	100
TOTAL			**20**	**04**	**06**	**24**	**30**	**180**	**60**	**360**	**120**	**180**	**1000**

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B TECH MECHANICAL ENGINEERING SEMESTER –VIII TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017														
SR NO	**CODE**	**SUBJECTS**	**TEACHING SCHEME**			**CREDITS**	**HOURS**	**EXAMINATION SCHEME**						
								THEORY			**PRACT**		**TOTAL**	
								CIE						
			L	**T**	**P**			**MID**	**IE**	**ESE**	**CIE**	**ESE**		
1	ME0801	Project	00	00	40	20	40	00	00	00	40	60	100	
TOTAL			**00**	**00**	**40**	**20**	**40**	**00**	**00**	**00**	**40**	**60**	**100**	

3RD SEMESTER

B TECH MECHANICAL ENGINEERING SEMESTER –III TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	SH0301	Differential Equations and Integral Transforms	03	02	00	04	30	30	10	60	00	00	100
2	ME0301	Kinematics of Machines	03	02	00	04	30	30	10	60	00	00	100
3	ME0302	Fluid Mechanics	03	00	02	04	30	30	10	60	40	60	200
4	ME0303	Strength of Materials	03	02	02	05	30	30	10	60	40	60	200
5	ME0304	Material Science and Metallurgy	03	00	02	04	30	30	10	60	40	60	200
6	ME0305	Measurement Techniques and Instrumentation	03	00	02	04	30	30	10	60	40	60	200
7	SH0307	Human Values and Professional Ethics	01	00	00	00	00	00	00	00	00	00	100
TOTAL			**19**	**06**	**08**	**25**	**180**	**25**	**60**	**360**	**160**	**240**	**1100**

Subject: **Differential Equations and Integral Transforms**								
Program: B.Tech. Mechanical Engineering			Subject Code:SH0301			Semester: **III**		
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	60	00	40	00	100

1. Course Outcomes:

- To provide an ability to see differential equations as a rigorous way of modelling physical phenomena.
- To provide an ability to derive major differential equations from physical principles.
- To provide an ability to understand the role of initial and boundary conditions in determining the solutions of equations.
- To provide an ability to choose and apply appropriate methods for solving differential equations.
- To provide an ability to undertake problem identification, formulation and solution.
- To provide an ability to calculate Laplace transforms and inverse Laplace transforms and uses them to solve differential equations (Initial value problems, Boundary value problems).
- To provide an ability to understand various concepts of Control System -Theory using Laplace Transform.

2. Contents:

UNIT-I **[12 Hours]**

Ordinary Differential Equations with applications: Revision of ordinary differential equation: Introduction of Mathematical Modeling, Basic Definitions, First Order First Degree Differential Equations, Variable Separable equation, Homogeneous Equation, Exact Differential Equations, Reduction of Non-exact Differential Equations to exact form using Integrating Factors, First Order Linear Differential Equation, Bernoulli Equation, Applications: Orthogonal Trajectories, Simple Electric Circuits, Solution of Linear differential equations of higher order with constant coefficients, complimentary function and particular integral.

UNIT-II **[12 Hours]**

Ordinary and Partial Differential Equations with applications: Method of variation of parameters, Method of Undetermined coefficients, Linear differential equations with variable coefficients (Cauchy's and Legendre forms), Simultaneous linear differential equations, Bessel

and Legendre functions, Application of Linear differential equation - Application ofDeflection of Beams, Electric circuits, Series Solution of Ordinary Differential Equations – Power series method, Formation of Partial differential equations, Directly Integrable equations, Method of separation of variables, solution of one dimensional wave equation, heat equation and Laplace equation.

UNIT-III **[12 Hours]**

Laplace transforms: Relation between Laplace and Fourier Transform, Definition, Linearity property, Laplace transforms of elementary functions, Shifting theorem, Inverse Laplace transforms, Laplace transforms of derivatives and integrals, Convolution theorem, Application of Laplace transform in solving ordinary differential equations, Laplace transforms of periodic, Unit step and impulse functions.

UNIT-IV **[12 Hours]**

Fourier series, Fourier Integrals, Fourier Transforms and Z-Transforms: Fourier series, Drichlet's conditions, Euler's formula, Fourier expansion of periodic functions, Fourier series of even and odd functions, Half range Fourier series, Fourier integral theorem (only statement), Fourier sine and cosine integrals, Complex form of Fourier integral, Fourier transforms, Fourier sine and cosine transforms, Introduction to Z-transforms:Definition and Standard Z-transforms, Linearity Property, dumping Rule and some standard results, Some useful Z-transforms.

3. Text books:

1. Erwin Kreyszig: Advanced Engineering Mathematics (8th Ed.) , Wiley Eastern Ltd., New Delhi.

4. Reference Books:

1) B. V. Ramana: Higher Engineering Mathematics, Mc Graw Hill, New Delhi.
2) Dr. B.S. Growl: Higher Engineering Mathematics, Khanna Publishers, New Delhi.
3) R K Jain, S R K Iyengar: Advanced Engineering Mathematics. Third Edition, Narosa Publishing House
4) Merel C Potter, J L Goldberg: Advanced Engineering Mathematics (3rd Ed.), Oxford India Publication.
5) Murray Spiegel: Advanced Mathematics for Engineering & Science: (Schaum's Outline Series),Tata – McGraw Hill Publication

5. Digital resources

http://freevideolectures.com/blog/2010/11/130-nptel-iit-online-courses/
http://nptel.ac.in/video.php?subjectId=122107036
http://ocw.mit.edu/index.htm
https://www.khanacademy.org/

Subject: Kinematics of Machines								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0301**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	24/60	0	16/40	0	100

Course Objectives and Outcomes:

1. To synthesis planar mechanisms.
2. To perform mechanism analyses to find the position, velocity and acceleration.
3. To synthesis mechanism to perform certain prescribed task/motion.

Content

UNIT-I **[08]**

Mechanisms & Machines:

Terminology and Definitions, Mechanism & Machines. Rigid and resistance body, link, Kinematic pair, types of motion, degrees of freedom, classification of Kinematic pairs, Kinematic Chain, Linkage, Mechanics, Kinematic Inversion of Single and Double slider crank Chain, Four bar chain mechanism with lower pairs, Steering gear mechanisms such as Davis and Ackermann Steering gear.

UNIT-II **[12]**

Belt Rope and Chain:

Introduction, belt and ropes drives, selection of belt drive, types of belt drives, Materials used for belt and rope drives, law of belting, velocity ratio, tension ratio, Length of belt, V-belts, Wire rope, Slip and Creep of belt drive, angle of contact, centrifugal tension, Maximum power transmitted by belt.

Gears & Gear Trains

Introduction, Classification of Gears, Gear Terminology, Law of Gearing, Velocity of Sliding, Forms of teeth, Involute Profile Teeth, Arc of the contact, Numbers of pairs of teeth in contact, Interference in involute Gears, Minimum Number of teeth, Under cutting, Comparison of

Cyclonical and involutes tooth forms, Efficiency Of Helical, Spiral, Worm, Worm Gear, and Bevel Gears. Simple, Compound, Reverted & Epicyclical gear trains.

UNIT-III **[08]**

Velocity and Acceleration Diagrams of Mechanisms

Velocity and acceleration analysis in simple mechanisms, Graphical Method ,velocity and acceleration polygons, Instantaneous Centre of Velocity, Kennedy Theorem, Angular velocity ratio theorem, Coriolis acceleration component.

UNIT-IV **[14]**

Cam and Followers

Introduction, Definitions of cam and followers their uses, Types of Cams, Types of Followers and their motion, Cam Terminology, Displacement Diagrams, Graphical construction of the cam profile Motion of the Followers, Analysis of motion of followers, Tangent circular arc and eccentric cam.

Kinematic Synthesis of Mechanisms

Types of synthesis, Chebyshev's spacing for accuracy points, Freudenstein's equation, motion generation, function generation, position synthesis, and graphical synthesis, path generation.

Reference Books

1. Shigley, J.E and Uicker, J.J: Theory of Machines and Mechanisms, Oxford University Press
2. Rattan S.S.: Theory of Machines Tata McGraw-Hill Publishing Co. Ltd. New Delhi,
3. Rao J.S. and Dukkipati R.V: Mechanisms and theory Machines theory, Wiley Eastern Ltd.
4. Mabie H.H and Ocvirk, F.W: Kinematic and Dynamics of Machinery,3rd Edition ,John wiley and sons.
5. Green, W.G: Theory of Machines, 2nd Edition, Blackie, London, 1992.
6. Hollowenko, A.R: Dynamics of Machinery, John wiley and sons. Inc. New York, 1955.
7. Wilson, Kinematics and Dynamics of Machinery, 3rd Edition, Pearson Education.
8. Bevan Thomas, Theory of Machines

Subject: Fluid Mechanics								
Program: B..Tech. Mechanical Engineering				**Subject Code: ME0302**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. Provide fundamental knowledge of fluid.
2. Develop basic understanding of Fluid properties.
3. Give the knowledge of behavior of fluid under various conditions.

Course Outcomes

1. Understand the fundamentals of Fluid Mechanics and related applications.
2. Know basics of fluid kinematics and dynamics and their applications.
3. Formulate basic equations for Fluid Engineering problems.
4. Calibrate various fluid flow measuring devices.
5. Understand the necessity and concept of dimensional analysis, boundary layer and compressible fluid flow.

Content

UNIT-I **[08]**

Properties of Fluid

Fluid, ideal and real fluid, properties of fluid: mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapor pressure, compressibility and bulk modulus. Newtonian and Non-Newtonian fluids.

Fluid Statics

Pressure, Pascal's law, Hydrostatic law, Manometer, Hydrostatic forces on submerged planes and curved surfaces, Buoyancy and Flotation.

UNIT-II **[12]**

Fluid Kinematics

Description of fluid motion, Lagrangian and Eulerian approach, Type of fluid flow, Type of flow lines-path line, streak line, stream line, stream tube. Continuity equation, acceleration of a fluid particle, motion of fluid particle along curved path, Normal and tangential acceleration, Rotational flow, Rotation and Vorticity, circulation, stream and potential function, flow net, its characteristics and utilities.

Fluid Dynamics

Euler's Equation, Bernoulli's equation and its practical application, Venturimeter, Orifice meter, Nozzle, Pitot tube, Impulse momentum equation, Momentum of Momentum equation, Kinetic energy and Momentum correction factor, Vortex motion, Radial flow.

UNIT-III **[08]**

Viscous Flow

Flow of viscous fluids in circular pipe, shear stress and pressure gradient relationship, Velocity distribution, Hagen Poiseuille Equation, flow of viscous fluids between two parallel plates (Couette flow), shear stress and pressure gradient relationship, Velocity distribution, Drop of pressure head.

Turbulent Flow

Reynolds's experiment, Effect of turbulence, Expression for loss of head due to friction in pipes (Darcy-Weisbach equation), Expression for co-efficient of friction in terms of shear stress.

UNIT-IV **[08]**

Compressible Fluid Flow

Basic Thermodynamic relations, Basic equations for one dimensional compressible flow, stagnation properties, pressure wave propagation and sound velocity, Flow through nozzles

Dimensional Analysis and Model Analysis

Methods of dimensional analysis, Rayleigh's method, Buckingham's theorem, Limitations.

Dimensionless number and their significance, model laws, Reynolds model law, Fraude's model law, Euler's model law, Weber's model law, Mach's model law, Type of models, scale effect in model, limitation of hydraulic similitude.

Text Books

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar– Kataria & Sons – New Delhi
2. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd., Delhi

Reference Books

1. Fluid Mechanics & Hydraulics Machines-R.K.Bansal-Laxmi Publications.Delhi
2. Engineering Fluid Mechanics –K.L. Kumar, Eurasia Publication House, Delhi
3. Mechanics of Fluid – B.S. Massey – English Language Book Society (U.K.)
4. Fluid Mechanics- Yunush A. Cengel, John M. Cimbala- MH, Delhi
5. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas- MH, Delhi
6. Hydraulics and Fluid Mechanics Including Hydraulic Machine- PN Modi, & SM Seth-
7. Theory and Application of Fluid Mechanics- K.Subramanya-TMH Delhi
8. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd., Delhi

Web resources

http://nptel.ac.in/courses/112105171/

http://nptel.ac.in/courses/112104118/

List of Experiments for Fluid Mechanics:

1. Introduction to Laboratory, Lab Manual and Lab components.
2. To study buoyancy and floatation.
3. To determine the meta-centric height.
4. Verification of Bernoulli's theorem.
5. Verification of relationship between energy loss and velocity and determination of friction factor for a pipe.
6. Reynolds experiment: Establishment of laminar, transition & turbulent flows.
7. Determination of the co-efficient of discharge, velocity and contraction.
8. Verification of law of hydrostatic pressure
9. To study about open channel flow over a notch and to find co-efficient of discharge of rectangular notch.
10. To study about open channel flow over a notch and to find co-efficient of discharge of V-

notch.

11. Study of a pitot-tube
12. To study about Dimensional Analysis.
13. To study about various Model laws and Model Analysis.
14. To study about Venturi-meter and determine the co-efficient of Discharge through Venturi-meter.
15. To study about Orifice meter and determine the co-efficient of Discharge through Orifice meter.
16. To determine flow rate using Rotameter.

Subject: Strength of Materials								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0303**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. To gain a fundamental understanding of the concepts of stress and strain by analysis of solids and structures.
2. To study engineering properties of materials, force-deformation and stress-strain relationship
3. To learn fundamental principles of equilibrium, compatibility, and force-deformation relationship, and principle of superposition in linear solids and structures
4. To analyze; determinate and indeterminate axial members, tensional members and beams to determine axial forces, torque, shear forces, bending moments, slopes and deflection.
5. To determine stress, strain, and deformation of bars, beams and springs.
6. To be able to perform structural analysis by hand computations and design axial and tensional members.

Course Outcomes

1. Analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.
2. Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight.
3. Perform engineering work in accordance with ethical and economic constraints related to the design of structures and machine parts.

Content

UNIT-I **[14]**

Introduction

Basic of Stress & Strain, elastic constants, and stress – strain diagram, Hooke's law, Poisson's ratio, shear stresses, Relation between Elastic modules E, C, &K. Stress induced in compound struts. , thermal stresses.

UNIT-II **[14]**

Theories of Failure

Maximum Principal Stress theory, maximum Shear Stress theory, strain energy theory, shear strain energy, Maximum Principal strain energy.

Principal Stresses and Strain

Stress in Tensile member due to pure shearing, two mutually perpendicular direct stress, principal plane, principal stresses, Mohr circle of stress.

UNIT-III **[16]**

Beams

Introduction of Beams, Various type of Beams, Various type of Supports, Reactions at supports, Shear force and bending moment at any section of a beam, Methods for determination of S.F. and B.M. diagrams of beams (simply supported, overhang and cantilever) subjected to various loads, Relation between Shear Force and Bending Moment, Point of contra-flexure.

Bending of Beams

Theory of simple bending, section modulus, symmetric section practical application of bending equation.

Deflection of Beam

Relation between slope deflection and radius of curvature, problem by Macaulay's method, Double integration method, Moment Area Method, Conjugate Beam method.

UNIT-IV **[12]**

Torsion

Deformation in circular shaft due to torsion, basic assumptions, torsion equations, stresses in elastic range, angular deflection, hollow & stepped circular shaft.

Columns and Struts

Classification, end condition, equivalent length, Euler's theory formula, limitation, application, derivation, Rankine's hypothesis.

Text Books:

1. Strength of Materials – R.K. Rajput – Schand Publication
2. Strength of Materials – Dr. Sadhu Singh – Khanna publication

Reference Books:

1. Elements of Strength of Material – Timoshenko & Young- EWP press
2. Mechanics of Material-Gere and Timoshenko CBS Publications
3. Mechanics of Solids – Beer & Johnson, Tata McGraw Hill Publications
4. Strength of material – Ryder–ELBS
5. Introduction to Solid Mechanics – I. H. Shames–PHI
6. Engineering Mechanics of Solids – E.P. Popov – PHI

List of Experiments

1. To study tensile test.
2. To study compression test.
3. To study Torsion test.
4. To study Fatigue test.
5. To study Impact test.
6. To study Brinell hardness test.
7. To study Rockwell hardness test.
8. To study Deflection of Beam.
9. To study various type of strain gauge.
10. To study crab winch**.**

Subject: Material Science & Metallurgy								
Program: B. Tech Mechanical Engineering				**Subject Code: ME0304**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives:

1. To understand various properties of materials.
2. To understand how and why the properties of materials are controlled by its structure at the microscopic and macroscopic levels.
3. To understand how to provide the heat treatment to various metals & alloys.
4. To understand the inter-relationship between composition, structure and properties of engineering materials.
5. Get knowledge about checking of materials by applying Nondestructive testing method.

Course Outcomes:

1. Students could able to understand mechanical, electrical, thermal properties & its role on metals.
2. Students could able to identify defects on materials by performing different NDT test.
3. Students can get the knowledge about different types of heat treatment methods & which method needs to apply for particular missing properties on the materials.

UNIT-I **[06]**

Introduction

History of Material Science, Definition of Metallurgy & its application, microscopic & macroscopic examination, different types of engineering materials, selection criteria for engineering materials, concept of stress & strain, stress & strain diagrams, different types of Physical, Mechanical, Electrical, Thermal, Magnetic Properties of materials

Solidification in Metals

Nucleus formation & crystal growth, Homogeneous & heterogeneous nucleation, grain, grain

boundary, grain growth, solidification process, effect of grain size on properties of Metals.

UNIT-II **[09]**

Deformation of Metals

Elastic and plastic deformation, slip, twin, differences between slip & twinning, dislocation - edge & screw, critical resolved shear stress, season cracking, Baushinger effect, different types of point, line, surface & volume defects, effect on properties like recovery, recrystallization crystallization and grain size, cold and hot working processes.

Phase & Phase Equilibrium Diagrams:

Phase and phase equilibrium: Gibb's phase rule, Hume-Rothery's rule, Types of Phase Equilibrium diagrams: Isomorphism- Lever rule, Monotectic, Eutectic-Hyper, hypoeutectic, Eutectoid- Hyper, hypo eutectoid, Peritectic and Peritectoid system- Iron &Iron carbon equilibrium diagram, Allotropy of iron and Fe-C diagram.

UNIT-III **[10]**

Heat Treatment of Carbon and Alloy Steels

Introduction, purpose and advantages of heat treatment, defects due to faulty heat treatment, T-T-T curve and micro constituents in steel heat treatment processes like Annealing-stress relief, spheroidising, Process and Full annealing; Normalizing, Hardening, Tempering- Austempering, Martempering, Surface hardening-Flame,

Induction and Case hardening: Carburizing- Pack and Gas carburizing, Nitriding, Cyaniding, Carbon-Nitriding.

Cast Iron

Manufacturing techniques of White Cast Iron, Grey Cast Iron, Malleable Cast Iron, S. G. Iron, Alloy Cast Iron. Their microstructures and correlated properties and application.

UNIT-IV **[14]**

Destructive & Non-destructive Testing

Tensile test, Hardness test, Impact test, Radiography, liquid penetration test, magnetic particle testing, ultrasonic testing, Jominy and quench test, concrete test hammer, eddy current test.

Corrosion

Introduction, factor affecting corrosion, types of corrosion, control and prevention of corrosion.

Powder Metallurgy

Application and advantages, Production of powder, Compacting, Sintering, Equipment and process capability.

Reference Books

1.Material Science & Metallurgy by Upadhyay , Atul Prakashan.

2.Material Science and Metallurgy by O.P Khanna, Dhanpat Rai Publications

3.Engineering Materials by R. K Rajput, S. Chand Publications.

4.Material Science & Engineering – An Introduction by W.D. Callister, John Wiley

5.Introduction to Materials Science for Engineers – James Shackelford, Pearson, Prentice Hall; 8 edition.

6.Elements of Materials Science –by L.H. Vanvlack, Addision-Wisley Series

7.Element s of Metallurgy by D. Swarup Rastogi Publication

List of Experiments:

1. To study about basics of material science and metallurgy.
2. To study about cast iron.
3. To study about the effects of alloying elements on cast iron.
4. To perform micro examination of standard specimen.
5. To study about iron carbon diagram & allotropy of iron.
6. To study about heat treatment and check effect of quenching media on hardness of steel.
7. To measure hardenability of given material with Jominy hardenability test.
8. To perform liquid penetration test for given sample.
9. To study of magnetic particle test.
10. To study of ultrasonic test.

Subject: Measurement Techniques and Instrumentation								
Program: B. Tech. Mechanical Engineering				Subject Code: ME0305			Semester: III	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. To understand basic concept of measurement techniques, metrology and instrumentation
2. To understand the various temperature and pressure measurement techniques
3. To study about linear, angular and taper measuring instruments
4. To study about screw thread and gear measurements
5. To study about measurement of surface finish
6. To study about Straightness, Flatness, Squareness, Parallelism and Machine Tool Tests

Course Outcomes

1. Students will be able to describe basic concept of Measurement Techniques, metrology and Instrumentation
2. Students will be able to evaluate quality of surface produced using various methods
3. Students will be able to describe basic concepts of mechanical measurement and errors in measurements
4. Students will be able to select appropriate temperature measuring device for various applications
5. Enables students to have a strong foundation in area of Measurement Techniques and Instrumentation

Content

UNIT-I **[06]**

Introduction to Metrology

Meaning, Necessity and Objectives of Metrology; Standards of Measurement; Elements of

Measuring System; Methods of Measurement; Precision and Accuracy; Sources of Errors; Selection and Care of instruments; Standardizing organizations**.**

Basic Concepts of Measurements

Introduction, Measurement and its aim; Generalized Measurement system; Performance Characteristics –static & dynamic characteristics of instruments, types of measurement system, Transducers, Instrumental error & its analysis.

UNIT-II **[08]**

Temperature Measurement

Introduction; Temperature and Temperature Scales; Methods of temperature Measurement; Expansion thermometers; Filled System thermometers; Electrical temperature measuring instrument; Pyrometers; Calibration of temperature measuring instruments.

Pressure Measurement

Introduction; Pressure standards and methods of pressure measurement; Manometers; Elastic pressure transducers; Measurement of Vacuum; Force balance pressure gauges; Electrical pressure transducers; pressure switches; Calibration of pressure measuring instruments, Maintenance and repair of pressure measuring instrument; Trouble shooting.

UNIT-III **[12]**

Linear Measurements

Introduction & classification of Linear Measuring Instruments; Least count; Engineer's Steel rule; Calipers; Vernier Calliper: working principle, construction, types & precautions to be taken; Vernier Height Gauge; Vernier Depth Gauge, Micrometers: principle, construction, Sources of errors and precautions to be taken, types of micrometers, Miscellaneous linear measuring instruments like bore gauge, telescopic gauge, slip gauges, Dial indicators: construction & working; comparators; calibration of various linear measuring instruments; Applications, Advantages & Limitations of commonly used linear measuring instruments.

Screw Thread and Gear Measurements

Introduction & classification of Threads; Elements, Specification & forms of Screw Threads; Various Methods for measuring elements of External & Internal Screw Thread; Screw Thread Gauges; Errors in Threads. Introduction & Classification of gears; Forms of gear teeth; Gear tooth terminology; Measurement and testing of spur gear: Various methods of measuring tooth

UNIT-IV **[14]**

Angular and Taper Measurements

Introduction; Working principle & construction of Angular Measuring instruments like Protractors, Sine bars, Sine centre, Angle gauges, Spirit level, Clinometers, angle dekkor; Applications, Advantages & limitations of commonly used angular measuring instruments; Taper Measuring instruments: Measurement of taper shafts & holes.

Measurement of Surface Finish

Introduction; Surface Texture; Methods of Measuring Surface finish- Comparison Methods & Direct Instrument Measurement; Sample Length; Numerical Evaluation of Surface Texture; Indication of Surface roughness Symbols used; Adverse effects of poor surface finish.

Straightness, Flatness, Squareness, Parallelism and Machine Tool Tests

Introduction; Measurement of Straightness, Flatness, Square ness and Parallelism; run out and concentricity; tool makers microscope; Interferometer & its use in checking flatness, surface contour, parallelism etc.; Interferometers & optical flats; Introduction to Machine tool testing; Various Alignment test on lathe, Milling Machine, Drilling Machine etc

Text Books

1. "Mechanical Measurement and Metrology", R K Jain, Khanna Publishers
2. "Industrial Instrumentation & Control", S K Singh, Tata McGrawHill
3. "Mechanical Measurement & Control", D.S. Kumar, Metropolitan Book Pvt Ltd

Reference Books

1. "Metrology and Measurement", A K Bewoor, V A Kulkarni, McGraw Hill Publication
2. "Instrumentation, measurement and Analysis", B C Nakra, K KChaudhary, Tata McGrawHill Publication
3. "Measurement and Instrumentation – Trends and Application", M K Gosh, S Sen, S Mukhopadhyay, Ane Books Pvt Ltd.

List of Experiments

1. Introduction to metrology.
2. Measuring by vernier calipers.
3. Measuring by outside micrometer.

4. Measuring of internal bores by inside micrometer.
5. Calibration of vernier caliper and micrometer using slip gauge.
6. Measurements using vernier height gauge and vernier depth gauge.
7. Taper angle measurement using sine bar.
8. Measurement of angle using vernier bevel protractor.
9. Surface roughness measurement.
10. Screw thread measurement.

Subject: Human Values and Professional Ethics								
Program:B.Tech. ALL				**Subject Code:SH0307**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)-Theory**	**Continuous Internal Evaluation (CIE)-Practical**	**Total**
1	0	0	0	24/60	0	16/40	0	100

Course Objectives:

- To create an awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

Unit 1: Values and Self Development [04]

Social Values and individual Attitudes, Work ethics, Indian vision of Humanism, Moral and non moral valuation, Standards and principles, Value judgments. Importance of cultivation of values, Sense of duty, Devotion, Self reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.

Unit 2: Personality and Behavior Development [04]

Soul and scientific attitude. Goad and scientific attitude, positive thinking, integrity and discipline, punctuality, love and kindness. Avoiding fault, finding. Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, True friendship, Happiness vs. suffering love for truth. Aware of self destructive habits, Association and cooperation, doing best, saving nature.

Unit 3: Character and Competence [04]

Science vs. God, Holy books vs. Blind faith, Self management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of women, All religions and same message, Mind your mind, Self control, Honesty, Studying effectively.

Unit 4: Engineering Ethics [04]

Senses of 'Engineering Ethics', variety of moral issues, types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, consensus and controversy, models of professional roles, theories about right action, self interest, customs and religions, uses of ethical theories, Valuing time, Co-operation and commitment, Code of ethics, Sample codes – IEEE, ASCE, ASME and CSI.

Text Books:

1. Chakraborty, S. K., Values and Ethics for Organization Theory and Practice, Oxford University Press, New Delhi, 2001

2. Gaur R. R., Sangal R., Bagaria G. P., *A foundation course in Value Education*, 2009.

3. Gaur R. R., Sangal R., Bagaria G. P*., Teacher's Manual*, 2009.

4. Mike Martin and RolandSchinzinger, *Ethics in Engineering*, Mc Graw Hill. New York, 1996.

Reference Books:

1. Govindrajan M., Natrajan S. and Senthil Kumar V. S., Engineering Ethics (including Human Values), Prentice hall of India Ltd., New Delhi, 2004.
2. Frankena, W. K., *Ethics*, Prentice Hall of India, New Delhi, 1990.
3. Dhar P. L., Gaur R. R., *Science and Humanism*, Commonwealth Publishers, 1990.
4. TripathyA. N., *Human Values*, New Age International Publishers, 2003.
5. Seebauer E. G. and Robert L. Berry, *Fundamentals of Ethics for Scientists andEngineers*, Oxford University Press, 2000.
6. Banerjee B. P., *Foundations of Ethics and Management*, Excel Books, 2005.
7. Bajpai B. L., *Indian Ethos and Modern Management*, New Royal Book Company, 2004.

4TH SEMESTER

B TECH MECHANICAL ENGINEERING SEMESTER –IV TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	SH0401	Complex Analysis and Numerical Methods	3	2	0	4	5	30	10	60	00	00	100
2	ME0401	Engineering Thermodynamics	3	2	0	4	5	30	10	60	00	00	100
3	ME0402	Manufacturing Processes	4	0	2	5	6	30	10	60	40	60	200
4	ME0403	Dynamics of Machines	3	2	2	5	7	30	10	60	40	60	200
5	ME0404	Fluid Power Engineering	4	0	2	5	6	30	10	60	40	60	200
6	ME0405	Machine Drawing	1	2	0	2	3	30	10	60	00	00	100
7	CE0407	Cyber Security and IPR	1	0	0	0	1	00	00	00	00	00	100
TOTAL			**19**	**8**	**6**	**25**	**33**	**180**	**60**	**360**	**120**	**180**	**1000**

Subject: **Complex Analysis and Numerical Methods**								
Program: B. Tech Mechanical Engineering			Subject Code: SH0401			Semester: **IV**		
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	60	00	40	00	100

1. Course outcome

After completion of this course students will be able to gain knowledge about following

- To provide an ability to understand, interpret and use the basic concepts: complex number, analytic function, harmonic function, Taylor and Laurent series, singularity, residue, conformal mapping, meromorphic function.
- To provide an ability to prove certain fundamental theorems about analytic functions, e.g. Cauchy's integral formula
- To provide an ability to determine the images of curves under simple complex mappings.
- To provide an ability to determine the stability of certain dynamical systems using complex functions.
- To provide an ability to use conformal mapping to solve certain applied problems regarding heat conduction, electrical engineering and fluid mechanics.
- To provide an ability to use Taylor and Laurent expansions to derive properties of analytic and meromorphic functions.

2. Contents:

UNIT-I **[12 Hours]**

Complex Analytic Functions:

Complex Numbers, Demoivere's Theorem, Roots of Complex Numbers, Elementary complex functions, Complex planes, Curves in complex planes, Concept of neighborhood in The complex plane, Analytic function, Cauchy- Riemann equations (Cartesian and polar forms – without proof), Harmonic functions, conformal mappings, some standard conformal transformations.

UNIT-II **[12 Hours]**

Interpolation

Finite differences and Interpolation: Finite differences Forward, Backward & Central difference operators and difference tables. Interpolation, Interpolation Formulae with equal

intervals: Newton's forward, Newton's backward, central difference interpolation by Stirling's formulae

Interpolation Formulae with unequal intervals: Lagrange's & Newton's divided difference interpolation

Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule.

Numerical differentiation: Using Newton's forward and backward interpolation formula

UNIT-III **[12 Hours]**

Numerical Methods: Basic Errors.
Solution of Algebraic and Transcendental Equations: Bisection method, Regula-Falsi method, Newton-Raphson method, Convergence condition for these methods.
Numerical methods in Linear Algebra: Gauss-Jacobi, Gauss-seidel method
Largest Eigen values and corresponding Eigen vectors: By power method
Numerical Solutions of ordinary differential equations: Taylor's Method, Euler's Method, Improved Euler Method (Heun's Method), Runge-Kutta method of order four

UNIT-IV **[12 Hours]**

Complex Integration: Complex integration, Cauchy's integral theorem and Cauchy's integral formula (without proof), Singularities, Taylor's and Laurent's series, Cauchy-Residue theorem, Residues & Contour integration, Applications of residue to evaluate real integrals.

3. Text books:

1. Erwin Kreyszig: Advanced Engineering Mathematics (8^{th} Edition) Wiley Eastern Ltd., New Delhi (1999).

4. Reference Books:

1. R. V. Churchill and J. W. Brown: Complex variables and applications (7^{th} Edition), McGraw-Hill (2003)
2. B. V. Ramana: Higher Engineering Mathematics, McGraw Hill, New Delhi (2008).
3. Merel C Potter, J L Goldberg: Advanced Engineering Mathematics (3rd Edition) Oxford India Publication (2005).
4. Dr. B.S. Growl: Higher Engineering Mathematics, Khanna Publishers, New Delhi (2000).
5. R K Jain, S R K Iyengar: Advanced Engineering Mathematics. Third Edition, Narosa Publishing House (Reprint2014).
6. Murray Spiegel: Advanced Mathematics for Engineering & Science: (Schaum's Outline Series), TataMcGraw Hill Publication (2009).

5. Digital learning resources :

- http://freevideolectures.com/blog/2010/11/130-nptel-iit-online-courses/
- http://nptel.ac.in/video.php?subjectId=122107036
- http://ocw.mit.edu/index.htm
- https://www.khanacademy.org/

Subject: Engineering Thermodynamics								
Program: B. Tech Mechanical Engineering				**Subject Code: ME0401**			**Semester: IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	24/60	0	16/40	0	100

Course Objective

1. To understand the theory and applications of classical thermodynamics, thermodynamic properties, equations of state.
2. Understand the nature and role of the following thermodynamic properties of matter: internal energy, enthalpy, entropy, temperature, pressure and specific volume.

Course Outcome

1. Understand basic terms used in thermodynamics.
2. Understand laws of thermodynamics and its applications.
3. Comprehend the concept and applications of energy, entropy and exergy.
4. Understand various gas and vapor power cycles.
5. Understand the properties of gas mixtures

Content

UNIT-I **[06]**

Concepts of Thermodynamics

Microscopic & macroscopic point of view, thermodynamic system and control volume, thermodynamic properties, processes and cycles, Thermodynamic equilibrium, Quasi-static process

UNIT-II **[10]**

First law of Thermodynamics

First law for a closed system undergoing a cycle and change of state, Energy-A property of the system, Different forms of stored energy, Specific Heat at constant Volume and Pressure, Enthalpy, Energy of an Isolated system, Perpetual motion machine of the first kind-PMM1, Control Volume, Steady flow Process, Mass and Energy balance in a simple steady flow Process.

UNIT-III **[16]**

Second law of Thermodynamics

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence, PMM of Second kind, reversibility and irreversibility, causes of irreversibility, Carnot cycle, Carnot theorem, Absolute thermodynamic temperature scale.

Entropy

Clausius theorem, property of entropy, inequality of Clausius, entropy change in an irreversible process, principle of increase of entropy, entropy change for non-flow and flow processes, third law of thermodynamics

Energy

Available energy, availability of a closed system, availability function of a closed system availability of steady flow system, availability function of open system

Energy of a heat input in a cycle, exergy destruction in heat transfer process, exergy of finite heat capacity body, exergy of closed and steady flow system, irreversibility and Gouy-Stodola theorem and its applications, second law efficiency

UNIT-IV **[16]**

Thermodynamic Relationships

Maxwell's equations, T-ds equations, difference in heat capacities, coefficient of Volume expansion and isothermal compressibility, adiabatic compressibility, ratio of specific heat, energy equations, Joule-Kelvin effect, Clausius-Clapeyran equation.

Vapour Power Cycles

Simple Steam Power Cycle, Parameter of Vapour Power Cycle, Cannot Vapour Power Cycle,

Ideal Rankine cycle, Comparison of Carnot and Rankine Cycle, Effect of operating variable on Rankine Cycle, Reheating of Steam, Super Critical Rankine Cycle.

Air Standard Cycles

Concept of air standard cycles, Assumptions, Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, Comparison of Otto, Diesel and Dual cycles, Efficiency of air standard cycle, Mean Effective Pressure, Relative efficiency. Brayton cycle, effect of reheat, regeneration, intercooling and turbine and compressor efficiency on Brayton cycle

Properties of Gases and Gas Mixtures

Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart, Gibbs-Dalton law, internal energy; enthalpy and specific heat of a gas mixtures

Text Books

1. Engineering Thermodynamics by P.K. Nag, McGraw-Hill Education

Reference Books

1. Fundamentals of Thermodynamics by Borgnakke & Sonntag, 7th Ed. Wiley India (P) Ltd.
2. Thermodynamics – An Engineering Approach by Yunus Cengel & Boles, McGraw-Hill
3. Engineering Thermodynamics by Gordon Rogers and Yon Mayhew, Pearson Education Ltd.
4. Engineering Thermodynamics by Krieth, CRC Press
5. Engineering Thermodynamics by Jones and Dugan, PHI Learning Pvt. Ltd.

Subject: Manufacturing Processes								
Program: B. Tech. Mechanical Engineering				Subject Code: ME0402			Semester: IV	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	0	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. To understand various manufacturing processes & its classifications.
2. To understand various Casting processes.
3. To understand various welding processes.
4. To understand various metal removal process.
5. To appreciate the capabilities, advantages and the limitations of the processes.

Course Outcomes

1. Students will be able to understand about the various manufacturing processes in detail.
2. Students will be able to understand about the casting processes, welding processes, metal removal processes and the advantages, limitation and applications of all these processes.
3. Enables students to have a strong foundation in area of manufacturing processes.

Content

UNIT-I **[08]**

Introduction to Manufacturing Processes

Importance of manufacturing, economic and technological consideration, Classification of manufacturing processes, and their characteristics.

Plastic Processing

Introduction, Classification of Plastics, Ingredients of Molding compounds, General Properties of

Plastics, Plastic part manufacturing processes such as compression molding, Transfer molding, Injection molding, Extrusion molding, Blow molding, Calendaring, Thermoforming, slush molding, laminating.

UNIT-II **[10]**

Metal Joining Processes

Principle of welding, soldering, Brazing and adhesive bonding. Classification of welding and allied processes. Gas welding and gas cutting, Principle, Oxyacetylene welding equipment, Flame cutting. Arc welding, Power sources and consumables, Gas welding and cutting, Processes and Equipments. Resistance welding, Principle and Equipments, Spot, Projection and seam welding process, Atomic hydrogen, ultrasonic, Plasma and laser beam welding, Electron beam welding, and special welding processes e.g. TIG, MIG, friction and explosive welding, Welding defects. Electrodes and Electrode Coatings.

UNIT-III **[14]**

Forming and Shaping Processes

Metal working, Elastic and plastic deformation, Concept of strain hardening, Hot and cold working, Rolling, Principle and operations, roll pass sequence, Forging, forging operations, extrusion, Wire and tube drawing processes. Forging: Method of forging, Forging hammers and presses, Principle of forging tool design, Cold working processes- Bending, Shearing, Drawing, Squeezing, Blanking, Piercing, deep drawing, Coining and embossing, Metal working defects, cold heading, Riveting, Thread rolling bending and forming operation.

UNIT-IV **[22]**

Patterns Making

Pattern – Definition, Types of patterns, application, allowances and material used for patterns, molding materials, molding sands, molding sands; properties and sand testing; grain fineness; moisture content, clay content and permeability test, core materials and core making, core print; core boxes, chaplets, gating system design. molding practices: Green, dry and loam sand molding, pit and floor molding; shell molding; permanent molding; carbon dioxide molding.

Casting Types

Sand casting, Shell-Mould casting, Mold casting (plaster and ceramic), Investment casting,

Vacuum casting, Permanent mould casting, Slush casting, Pressure casting, Die casting, Centrifugal casting, Continuous casting, Squeeze casting, Casting alloys, Casting defects, Design of casting, Gating system design, and riser design. Melting furnaces, Metallurgical considerations in casting elements of gating system, and risers and their design.

Super Finishing Processes

Introduction, Grinding, Lapping, Horning, Buffing, Barrel Tumbling, Burnishing, Powder coating, Polishing

Text Books

1. Manufacturing Technology (Vol. – I & II) – P.N. Rao – Tata McGraw Hill Pub. Company, New Delhi.
2. A Text Book of Production Technology (Manufacturing Processes) – P.C. Sharma – S. Chand and Company Ltd., New Delhi.
3. Production technology, by R.K. Jain, Khanna publishers.
4. Production Technology by O.P.Khanna, Dhanpat Rai publishers.

Reference Books

1. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi
2. Manufacturing Engineering and Technology – S. Kalpakjian & S.R. Schmid – Addision Wesley Longman, New Delhi
3. Production Technology – R. K. Jain – Khanna Publishers, New Delhi
4. A Text Book of Production Technology (Vol. I & II) – O.P. Khanna – Dhanpat Rai & Sons, New Delhi.
5. Manufacturing Technology Vol-II, By P.N. Rao, Tata McGraw Hill.

List of Experiments

1. Experiment on Sand washer equipment.
2. Experiment on Sand Siever equipment.
3. Experiment on Sand Mullar equipment.

4. Experiment on Sand Mixing equipment.
5. Experiment on Moisture Test.
6. Experiment on Sand Remer equipment.
7. Experiment on Permeability Test.
8. Experiment on Core Hardness Test.
9. Fundamentals' on Metal Forming.
10. Study of Forging and Extrusion Process.
11. Experiment on Press working operations.
12. Experiment on Metal Joining Process.
13. Demonstration on Foundry Furnaces.
14. Study of Plastic Processing Technology.
15. Study of Super Finishing Processes.

Subject: Dynamics of Machines								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0403**			**Semester: IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	2	5	24/60	24/60	16/40	16/40	200

Course Objectives and Outcomes

1. Familiarity with common mechanisms used in machines and everyday life.
2. Ability to calculate mobility (number of degrees-of-freedom) and enumerate rigid links and types of joints within mechanisms.
3. Ability to conduct a complete (translational and rotational) velocity, acceleration analysis of the different mechanism.
4. Helps to understand various cam motion profiles and follower mechanism, their classification and design based on the prescribed follower motion (SHM, constant velocity and acceleration)
5. At the end of this unit students are able to understand gear mechanism classification and to become familiar with gear standardization and specification in design.

Content

UNIT-I **[14]**

Governors

Introduction, types of governors, centrifugal governors, spring loaded governors, sensitiveness of a governor, hunting, isochronisms, stability, effort and power of a governor, controlling force.

Gyroscope

Precessional angular velocity, angular acceleration, gyroscopic couple, effect of gyroscopic couple on aero plane, effect of gyroscopic couple on naval ships, stability of an four wheel vehicle , stability of a two wheel vehicle.

UNIT-II **[08]**

Inertial Forces in Reciprocating Parts

Velocity and acceleration of the piston, forces on the reciprocating parts of an engine, equivalent

dynamical system.

Turning Moment Diagram and Flywheel

Turning moment diagrams, fluctuation of energy and speed, coefficient of fluctuation of energy, coefficient of fluctuation of speed, energy stored in flywheel.

UNIT-III **[12]**

Static Force Analysis

constraint and applied forces, static equilibrium, equilibrium of two and three force members, members with two force, equilibrium of four force members, force convection, free body diagram.

Dynamic Force Analysis

D'Alembert's Principles, equivalent of inertia force, dynamic analysis of four link mechanisms, dynamic analysis of slider crank mechanism, velocity and acceleration of piston, angular velocity and angular acceleration of connecting rod, engine force analysis, turning moment on crank shaft, dynamically equivalent system.

UNIT-IV **[06]**

Balancing

Introduction, static balancing, dynamic balancing, balancing of several rotating masses in single and in different planes. Primary and secondary unbalanced forces of reciprocating masses, Balancing of reciprocating masses, variation of tractive force, sway couple, hammer blow , balancing of inline engines.

Text Books

1. Theory of Machines by S.S. Rattan, Tata McGraw Hill Companies
2. Mechanical Vibrations by G.K. Groover, Nem chand & Bro
3. Mechanical Vibrations by V. P. Singh, Dhanpat Rai & Co.

Reference Books

1. Theory of Machines by R.K. Bansal, S Chand
2. Theory of Machines and Mechanisms by Shigley, Pennock and Uicker, Oxford University Press.
3. Mechanical Vibration by Singiresu S. Rao, Pearson Education

List of Experiments

1. To study Porter Governor and verify experimentally.
2. To study Proell Governor and verify experimentally.
3. To study Hartnell Governor and verify experimentally.
4. To find radius of gyration of component suspended on two ends (Bifilar suspension).
5. To find radius of gyration of component suspended on three points (Trifilar Suspension).
6. Study of Gyroscope and its effect and to verify experimentally.
7. To study the principal method of Static balancing.
8. To study and experimentally validate dynamic balancing system.
9. To study static force analysis of a mechanism.
10. To study dynamic force analysis.

Subject: Fluid Power Engineering								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0404**			**Semester: IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
04	00	02	05	24/60	24/60	16/40	16/40	200

Course Objectives

1. Provide the detailed understanding and application of fluid power and hydraulics of machines
2. Understand the different major equipments which can produce power from fluid

Course Outcomes

1. To formulate basic equations for impact of free jets
2. To understand construction and working and performance of various Turbines
3. To understand construction and working & performance of various Pumps
4. To solve and analyze a variety of fluid mechanics and fluid machinery related problems.

Content

UNIT-I **[10]**

Flow Through Pipes

Loss of energy in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, equivalent pipe power transmission through pipe, water hammer in pipes.

UNIT-II **[10]**

Compressors

Reciprocating Compressors: Construction and working, Multistage conditions for minimum work, Intercooling, Efficiency and control of air compressors

Rotary Compressors: Introduction, Classification, roots blower, Vane type, Screw compressor, Scroll compressor

Centrifugal Compressors**:** Essential parts, Static and total head properties, Velocity diagram, Degree of reaction, surging and choking, Losses in centrifugal compressor

Miscellaneous Machines

Construction and working of hydraulic press, Hydraulic accumulator, Hydraulic intensifier, Hydraulic crane, Hydraulic jack, hydraulic lift, Hydraulic ram, Fluid couplings, Fluid torque converter and air lift pump.

UNIT-III **[14]**

Impact of Free Jets

Impulse momentum principle, force exerted by the jet on stationary flat and curved plate, hinged plate, moving plate and moving curve vanes, jet propulsion of ship.

Impulse Turbines

Classification of turbine, impulse turbine, Pelton wheel, Construction, working, work done, head efficiency and Design aspects, governing of impulse turbine, cavitation of turbines.

UNIT-IV **[14]**

Reaction Turbines

Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over Pelton wheel. Axial flow reaction turbine Propeller and Kaplan turbine, bulb or tubular turbine, draft tube, specific speed, unit quantities, cavitation, degree of reaction, performance characteristics, surge tanks, governing of reaction turbine.

Centrifugal Pumps

Classification of Pumps, Centrifugal pump, Construction, working, work done, heads, efficiencies, multistage centrifugal pump, pump in series and parallel, specific speed, characteristic, net positive suction head, cavitation.

Text Books

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar– Kataria & Sons -Delhi
2. Fluid Mechanics & Hydraulics Machines-R.K.Bansal- Laxmi Publications, Delhi
3. Fluid Mechanics- Yunush A Cengel, John M. Cimbala- TMH, Delhi

Reference Books

1. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd., Delhi

2. Mechanics of Fluid – B.S. Massey – English Language Book Society (U.K.)
3. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas- TMH, Delhi
4. Hydraulics and Fluid Mechanics Including Hydraulic Machine- PN Modi, & SM Seth- Standard, Delhi
5. Hydraulic Machines: Fundamentals of Hydraulic Power Systems – P. Kumar – BSP Books Pvt, Ltd., Hyderabad

List of Experiments

1. Performance practical on impact of jet.
2. Performance practical on Centrifugal pump characteristics.
3. Performance practical on Centrifugal pump characteristics (Double Stage).
4. Performance practical on Centrifugal pump characteristics (Variable speed).
5. Performance practical on Gear pumps characteristics.
6. Performance practical on Francis Turbine.
7. Performance practical on Pelton wheel turbine.
8. Performance practical on Kaplan Turbine.
9. Study of various hydraulic devices.

Subject: Machine Drawing								
Program: B.Tech. Mechanical Engineering				Subject Code: ME0405			Semester: IV	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
1	2	0	2	24/60	-	16/40	-	100

Course Objectives

1. Understand the different steps in producing drawings according to bureau of Indian standards (B.I.S.) as per SP:46 (1988-2003)
2. Understand the application of industry standards and techniques applied in Machine Drawing
3. Comprehend general projection theory, with an emphasis on the use of orthographic projection to represent three-dimensional objects in two-dimensional views
4. Apply auxiliary or sectional views to most practically represent engineered parts
5. Assemble important parts used in major mechanical engineering applications.

Course Outcomes

1. At the end of this course, students will be able to do tolerance analysis and specify appropriate tolerances for machine design applications.
2. Students will be acquainted with standards, safety, reliability, importance of dimensional parameters and manufacturing aspects in mechanical design.
3. Students will be able to improve their technical Drawing skills.

Content

UNIT-I **[04]**

Conventional representation of machine components & materials

leaf spring, leaf spring with eyes, coil spring (tension and compression), disc spring, spiral spring, splined shaft, serrated shaft, square end of shaft, ball and roller bearing, spur gearing, bevel gearing,

worm and worm wheel, straight knurling, diamond knurling, internal and external thread, method of designating and dimensioning metric thread & materials representation.

Blue print reading

Identification of line & surface, checking and correcting drawing

UNIT-II **[04]**

Screwed Fasteners

Drawing hexagonal nut and square nut, hexagonal headed bolt, square headed bolt and washer. Screw thread, Foundation of bolt, locking arrangement, stud, set screw.

Riveted Joint

Form and properties of snap or cup head rivet, failure of riveted joint, caulking and fullering process, dimensions of rivet joint, Type of riveted joints, single riveted lap joint, double riveted (chain) lap joint ,double riveted (zigzag) lap joint, single riveted (single strap) butt joint, single riveted (double straps) butt joint.

Welded joints

representation of form, location and size of welds,

UNIT-III **[04]**

Geometrical Dimensioning and Tolerance

Representation of Straightness, flatness, circularity, Cylindricity, parallelism, perpendicularity, angularity, concentricity and coaxiality, symmetry, radial run out and axial run out.

Allowances and Tolerance

Representation of dimensional tolerance of hole, shaft and fits, Unilateral, bilateral tolerance, Deviation representation of surface roughness and direction of lay of machining.

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UNIT-IV

CAD

Introduction, Advantage & Application of CAD, Concept of CAD, 2D drafting using AutoCAD, AutoCAD basic commands & applications, 2D drafting of machine part & assembly

Assembly Drawing in Auto CAD Software

Preparation of assembly drawing and bill of materials of following assemblies from its disassembled views in CAD Software:

1. Orthographic views in software.
2. Lap joint with representation of welding riveted and screw fasteners symbols.
3. Cotter joint Spigot and Cotter joint
4. Pin Joint or Knuckle joint
5. Foot Step Bearing
6. Flexible coupling

Text Books

1. Machine Drawing, N.D. Bhatt, Charotar Book Stall, Anand
2. Machine Drawing, R.B Gupta, Tech India Publication
3. A Text Book of Machine Drawing, P.S.Gill, S.K.Kataria, Delhi

Reference Books

1. Machine Drawing, R.K.Dhawan,S,Chand,Delhi
2. Textbook of Machine Drawing, K.C. John,PHI,Delhi
3. Machine Drawing, N.Sidheswar,P. Kannaiah, &V.V.S. Sastry, TMH,Delhi
4. Machine Drawing With Autocad,, Pohit, Goutam & Ghosh, Goutam,Pearson,Delhi
5. Engineering Drawing Practice for School & Colleges, SP 46:2003, Bureau of Indian Standards

Web resources: www.nptel.ac.in

Subject: Cyber Security and Intellectual Property Rights								
Program: **B.Tech.**				Subject Code: CE0407			Semester: I**V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	0	0	0		0		0	

UNIT-I **[3]**

Introduction:

Information Security Overview, Cyber security, Cyber security objectives and policies, Differences between Information Security & Cyber security, Cyber security Principles, Introduction of Cyber crime, Classifications of Cybercrimes.

UNIT-II **[3]**

Security Threats and vulnerabilities:

Overview of Security threats, Hacking Techniques, Password Cracking, Insecure Network connections, Malicious Code, Programming Bugs, Cyber crime and Cyber terrorism, Information Warfare and Surveillance. Application security (Database, E-mail and Internet).

UNIT-III **[3]**

Overview of Security Management:

Overview of Security Management , Security Policy , Security Procedures and Guidelines , Risk Management , Security Laws**, System Security** (Desktop, email,web), **I**ntrusion Detection Systems, Security Technology-Firewall and VPNs ,Backup Security Measures.

UNIT-IV **[3]**

Cyber law- Intellectual property right:

Introduction, Objectives of Intellectual property law, Types of IPR, Advantages of IPR, IPR in India, Offences and Penalties.

Text Books

1. "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Nina Godbole, Sunit Belapur, Wiley India Publications, April, 2011

Reference Books

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security ", Pearson Education India.
2. .K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla ,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press.
4. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill.
5. CHANDER, HARISH**,"** Cyber Laws And It Protection **"** , PHI Learning Private Limited ,Delhi ,India

5TH SEMESTER

B TECH MECHANICAL ENGINEERING SEMESTER –V TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	ME0501	Heat and Mass Transfer	03	02	02	05	07	30	10	60	40	60	200
2	ME0502	Computer Aided Design and Analysis	04	00	02	05	06	30	10	60	40	60	200
3	ME0503	Design of Machine Elements	03	02	00	04	05	30	10	60	00	00	100
4	ME0504	Machining Processes	03	00	02	04	05	30	10	60	40	60	200
5	ME0505	Industrial Engineering	03	00	00	03	03	30	10	60	00	00	100
6	ME0506	Automobile Systems	03	00	02	04	05	30	10	60	40	60	200
7	SH0507	Technical Communication and Soft Skill	01	00	00	00	01	00	00	00	00	00	100
TOTAL			**20**	**04**	**08**	**25**	**32**	**180**	**60**	**360**	**160**	**240**	**1100**

Subject: Heat and Mass Transfer								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0501**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	2	5	24/60	24/60	16/40	16/40	200

Course Objective

1. This course is designed to introduce a basic study of the phenomena of heat and mass transfer, to develop methodologies for solving a wide variety of practical engineering problems,
2. The subject will provide useful information concerning the performance and design of particular systems and processes like heat exchangers etc.

Course Outcome

1. After learning the course the students should be able to:
2. Understand basic concept of heat transfer
3. Able to do basic calculations involving heat transfer as is typical for a mechanical engineer.
4. This includes conduction, convection and radiation heat transfer as well as heat exchanger design.
5. Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to conduction, convection and radiation heat transfer.

Content

UNIT-I **[06]**

Mass Transfer

Diffusion mass transfer, Fick's law of diffusion, steady state molecular diffusion, convective mass transfer, convective mass transfer correlation heat and mass transfer analogy.

UNIT-II **[12]**

Thermal Radiation-Basic Ralations

Absorptivity, reflectivity and transmissivity, black, white and grey body, emissive power and emissivity, laws of radiation – Planck, Stefan-Boltzmann, Wein's displacement, Kirchoff, intensity of radiation and solid angle, Lambert's cosine law.

Radiation Exchange Between Surfaces

Radiation heat exchange between black bodies, radiation shield, electrical analogy.

UNIT-III **[15]**

Conduction – Steady State

Fourier's law of heat conduction, derivation of generalized equation in Cartesian coordinates and its reduction to specific cases, three dimensional heat conduction equations in cylindrical and spherical co-ordinates, One dimensional steady state conduction, heat conduction through plane and composite walls, hollow and composite cylinders, hollow and composite spheres, electrical analogy, overall heat transfer coefficient, Critical thickness of insulation, Types of fin, heat flow through rectangular fin.

Conduction-Unsteady State (Transient)

Transient heat conduction- lumped heat capacity analysis, time constant, transient heat conduction in solids with finite conduction and convective resistances, Biot number.

UNIT-IV **[15]**

Forced and Free Convection

Newton's law of cooling, Dimensional analysis applied to forced and free convection, empirical correlations for free and forced convection, Continuity, momentum and energy equations, thermal and hydrodynamic boundary layer.

Heat Exchanger

Types, LMTD for parallel and counter flow exchanger, condenser and evaporator, overall heat transfer coefficient, effectiveness and number of transfer unit for parallel and counter flow heat exchanger, introduction to heat pipe, compact heat exchangers. Design parameters for radiator & water pump design, hoses, Thermostat Valve, Radiators Cap, Radiator fan, Radiator Fan shroud, Surge Tank. Design parameters and Synchronization of vehicular Engine cooling system for

dissipation of heat generated in Engine. Cooling system trouble diagnosis.

Text Books

1. Heat & Mass Transfer by R.K. Rajput, S. Chand & Co. New Delhi
2. Heat & Mass Transfer by P.K. Nag, Tata McGraw Hill, New Delhi.

Reference Books

1. Heat & Mass Transfer by R. C. Sachdeva, New Age International, New Delhi
2. Engineering Heat & Mass Transfer by M.M. Rathore, LaxmiPrakshan
3. Heat & Mass Transfer by Arora & Domkundwar, Dhanpatrai and Co., NewDelhi
4. Heat & Mass Transfer by Mills and Ganesan, Pearson Publication, New Delhi
5. Heat & Mass Transfer by B.K. Venkanna, PHI Learning, New Delhi.
6. Heat & mass transfer by by D.S. Kumar, S.K. Kataria& Sons

Web Resources

1. nptel.ac.in
2. www.learnerstv.com
3. cosmolearning.org

List of Experiments

1. To study fundamentals of heat transfer.
2. To determine thermal conductivity of insulating powder.
3. To determine the thermal conductivity of the given composite walls.
4. To measure convective heat transfer co-efficient and effectiveness of the fin under free & forced convection.
5. To determine heat transfer co-efficient by natural convection.
6. To determine heat transfer co-efficient by forced convection.
7. To determine Stephan Boltzmann constant experimentally.
8. To determine the emissivity of body.
9. To study of heat exchanger.
10. To study of mass transfer.

Subject: Computer Aided Design and Analysis								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0502**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	0	2	5	24/60	24/60	16/40	16/40	100

Course objective

1. To train the students with CAD packages like PRO-E and Solid Works.
2. To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.
3. To impart the 2D and 3D modeling skills to the students.
4. To develop understanding of how CAD technology can be leveraged in the design process.

Course outcomes:

1. Students will be able to design different parts of mechanical equipments.
2. Able to describe the principles of Computer Aided Designing systems and the concepts of Geometric modeling, solid modeling, and feature-based design modeling.

Content

UNIT-I **[06]**

Fundamentals of Computer Aided Design

Introduction, Reason for implementing CAD system & Computer applications in design, Conventional Design VS. CAD, Benefits of CAD, Technical specification of CAD workstation, CAD programming. Computer Software & Operating system for CAD.

UNIT-II **[12]**

Computer Graphics

Introduction, Scan conversions, DDA algorithm for generation of various geometries, 2D and 3D transformations: Scaling, Translation, Rotation, Mirroring, Clipping, Homogeneous

matrix.

Graphics Standards

Standards for graphics programming, features of GKS, other graphics standards, PHIGS, IGES, PDES. Standards in CAD.

UNIT-III **[10]**

Geometric Modeling

Types of Geometrical Models & Mathematical representation of curves, Wire frame models, Geometric entities, Geometrical representations, parametric representations. Parametric representation of synthetic curves, cubic curves, features, formulations and limitations of B – spline and Bezier curves, sweep curves. Surfaces & solids – model, entities, representations, fundamentals of surface and solid modeling, B-rep, constructive solid geometry (CSG), analytical modeling, sweep.

UNIT-IV **[12]**

Computer Aided Engineering

Finite Element Method: Introduction to FEM, Types of elements, types of error, derivation equitation finite element procedure, Stress – deflection – stiffness matrix, global matrix, Elimination approach, penalty approach.

Finite Volume method: Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of FEM with other methods, Variational approach, Galerkin's Methods.

Boundary element method: concept of boundary element method, basic terminology, fundamental solution, potential and boundary integral operators, Comparison of BEM with FEM.

Text Books

1. CAD/CAM: Computer Aided design and Manufacturing by Mikell Groover and Zimmer, Pearson Education
2. Computer Graphics - Hearn & Baker, PHI
3. Optimization Methods by S.S. Rao, New Age International Publications
4. Finite Element Analysis by Chendraupatla, EEE Publication.

5. CAD/CAM Theory & Practice by Ibrahim Zeid, Tata Mc Graw Hill

Reference Books

1. Computer Aided Engineering & Design by Jim Browne, New Age International Publications,
2. Computer Graphics & design by P. Radhakrishnan, C.P. Kothanadaraman, New Age Publication
3. Computer Aided Manufacturing by Tien Chien Chang, Richard, Wang Pearson Education
4. Computer Aided Analysis and Design of Machine Elements by Rao V. Dukkipati, M. Ananda Rao, Rama Bhat, New Age International Publications
5. Fundamentals of Computer Aided Design, by Vikram Sharma, KATSON educational series
6. Mathematical Elements for Computer Graphics - David F. Rogers & J. Alan Adams McGraw Hill
7. CAD / CAM - Chris McMohan, Jimmie Brown Addison – Wesley
8. CAD/CAM/CAE by Chougule N K, Scitech Publications Pvt. Ltd.

List of Experiments

1. To learn Fundamentals of CAD System, Software and hardware.
2. To prepare a computer program for scan converting a line using DDA Line Method.
3. To prepare a computer program for scan converting a Line using Bresenham's algorithm.
4. To prepare a computer program for scan converting a circle using Bresenham's algorithm.
5. To solve problems for 2D Transformation.
6. To study of solid and surface Modeling.
7. To study geometric Curves.
8. To study various Graphics Standards.
9. To learn about Computer Analysis Engineering techniques.

Subject: Design of Machine Elements								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0503**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	24/60	-	16/40	-	100

Course objective

1. To teach students how to apply the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components.
2. To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
3. To develop an ability to identify, formulate, and solve engineering problems.
4. To develop an ability to design permanent joints (riveted and welded) and detachable joints (cotter, knuckle, and keys) under various loading conditions.
5. To develop an ability to design a mechanical component such as power screw, levers, shaft, keys and couplings under various loading conditions.

Course outcomes

1. Able to analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts.
2. Able to select and size mechanical component to achieve design goals in the construction of mechanical systems.
3. Able to design machine elements to withstand the loads and deformations for a given application.
4. Able to design and analyze shafts with different geometrical features under various loading conditions.

Content

UNIT-I **[08]**

Introduction

General considerations in machine design, General procedure in machine design, selection of preferred sizes, selection of materials, standardization.

UNIT-II **[16]**

Design of Riveted Joints

Types of riveted joints, design of double and triple riveted butt joints with equal and unequal cover plates, Design of Circumferential joint, Longitudinal Butt Joint, Eccentric loading.

Welded Joints

Types of welded joints, stresses in welded joints, Design for various loading conditions in torsion, shear, or direct load, eccentrically loaded welded joints, welding symbols.

Miscellaneous Joints

Design of cotter, and knuckle joint.

UNIT-III **[12]**

Power Screws

Types of power screw threads, design of screw with different types of threads used in practice, Design of nuts, Design of C clamp.

Levers

General Procedure for design of levers, design of lever for safety valve, design of bell crank lever, design of rocker arm for exhaust valves.

UNIT-IV **[16]**

Shafts: Design of solid and hollow shaft for transmission of torque, bending moment and axial forces, Design of shaft for critical speed, design of shaft for rigidity and stiffness, flexible shafts.

Keys and Couplings: Design of different types of keys, Rigid coupling, Flange Coupling, Flexible coupling- Oldham, Universal coupling.

Text Books

1. V.B. Bhandari, Design of Machine Elements, Tata McGraw Hill Publishing Co
2. Design of Machine Elements, M.F.Spotts, T.E.Shoup, L.E.Hornberger, S.R.Jayaram and C.V. Venkatesh, Pearson Education
3. JosephShighly, Mechanical Engineering Design, Tata McGraw Hill Book Co.

Reference Books

1. Joseph Shigley, Charles Mischke, Thomas Brown, Standard Handbook of Machine Design, McGraw-Hill Publishing Co
2. Norton and Norton, Machine Design: An Integrated Approach, Pearson Publication

Subject: Machining Processes								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0504**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. To understand principle, working and characteristics of various Machine Tools used at shop floor.
2. To understand use of various machine tool in the industries.
3. To understand various operations done by various cutting tools for each machine tools.
4. To understand the use of various accessories attachments used for particular machine tools.

Course Outcomes

1. Understand the basic concept of Machine tools.
2. Understand the advantages, limitation and applications of the various machine tools.
3. Understand the usability of various machine tools as per the industry requirements.

Content

UNIT-I **[05]**

Basics of Machines Tools

Introduction,, function of machine tools, classification of machine tool, machine tool motions, properties of machine tools.

Boring Machine:

Purpose and filed of application, Horizontal boring machines, Precision boring machines

UNIT-II **[07]**

Drilling Machine

Introduction, types of drilling machines, specification of drilling machines, drilling operation, drilling tools, work & tool holding devices, machining parameters, machining time, boring machines

Sawing and Broaching Machines

Metal sawing classification: reciprocating sawing machines, circular sawing machines, band sawing machines. Types of broaching machine, advantage, disadvantage and limitations of broaching.

UNIT-III **[12]**

Shaper Machine

Introduction, types of shaper, components of shaper, shaper specification, shaper tools, work holding devices, shaper mechanism, machining parameters, machining time.

Planner Machine

Introduction, types of planner machines, components, specification of machine, work & tool holding devices, planner mechanism, machining parameters, machining time, difference between shaper and planner.

Grinding Machines and Abrasives

Classification of grinding machines, cylindrical grinders, internal grinders, Surface grinders, tool and cutter grinders, grinding wheel surface finishing. Abrasives, manufacturing or grinding wheels, selection and designation of grinding wheel, truing and dressing of grinding wheel.

UNIT-IV **[19]**

Lathe Machine

Introduction, types of lathes & specification of lathe, components of lathe, lathe operations, tool & work holding devices, transmission mechanism, machining parameters, machining time & material removal rate, Production Lathes (Capstan & Turret Lathe), Alignment tests of lathes.

Milling Machines

Introduction, types of milling, Components of milling, milling machine specification, milling

operations, milling cutters, work & tool holding devices, milling mechanism, Indexing mechanism, machining parameters, machining time.

Text Books

1. "Elements of W/S technology Vol-1& Vol-2 ", by S K Hajrachoudhury, A K Hajra
2. Choudhury, Nirjhar Roy, Media Promoters & Publishers PVT. LTD.
3. "Manufacturing Processes" by O.P. Khanna
4. "Manufacturing processes" by J.P.Kaushish, PHI PVT. LTD.

Reference Books

1. "Manufacturing Technology Vol-1 & Vol-2" by P N Rao, Tata McGraw-hill publishing company limited.

Web Resources: http://nptel.ac.in/courses

List of Experiments

1. Safety Rules in Mechanical Workshop.
2. Basics of Machine Tools.
3. To study of metal cutting Lathe machine and prepare the job.
4. To study of Drilling machine and prepare the job.
5. To study of Boring machine.
6. To study of Milling machine and prepare the job.
7. To study of Shaper machine and prepare the job.
8. To study of Planner machine and prepare the job.
9. To study of Sawing and Broaching machine.
10. To study of Cylindrical Grinding machine.
11. To study of Surface Grinding machine and prepare the job.

Subject: Industrial Engineering								
Program: B.Tech Mechanical Engineering				**Subject Code: ME0505**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. Industrial safety is needed to check all the possible chances of accidents for preventing loss of life and permanent disability of any industrial employee, any damage to machine and material as it leads to the loss to the whole establishment.
2. To eliminate accidents causing work stoppage and production loss.
3. To understand different types of maintenance.
4. Apply engineering principles to the work environment;
5. Use quality tools and data to anticipate and solve issues in the engineering process

Course Outcomes

1. Students could able to know the different Industrial acts.
2. Students are aware about basic terminology of maintenance.
3. Students can get an idea about the protective equipments in Industry. By knowing this he could avoid accidents.
4. An ability to select and apply the knowledge, techniques, skills, and modern tools of the
5. discipline to broadly-defined engineering technology activities
6. An ability to select and apply a knowledge of mathematics, science, engineering, and
7. technology to engineering technology problems that require the application of principles and applied procedures or methodologies;

Content

UNIT-I **[05]**

Introduction To The Development Of Industrial Safety And Management

History and development of Industrial safety: Implementation of factories act, Formation of various councils, Safety and productivity, Safety organizations. Safety committees, safety committee structure, Roll of management and roll of Govt. in industrial safety, Safety analysis.

Accident Preventions, Protective Equipment and The Acts

Personal protective equipment, Survey the causes and cost of accident, Housekeeping, First aid, Fire fighting equipment plant for locations and hazards, Part of body to be protected, Education and training in safety, Prevention, Accident reporting, Investigations, Industrial psychology in accident prevention, Safety trials.

UNIT-II **[10]**

Principles and Practices of Maintenance Planning

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability, Equipment Life cycle, Measures for Maintenance Performance: Equipments breakdowns, Mean Time Between Failures, Mean Time to Repair, Factors of availability, Maintenance organization, Maintenance economics.

Maintenance Policies and Preventive Maintenance

Maintenance categories – Comparative merits of each category – Preventive maintenance, Maintenance schedules: Repair cycle, Principles and methods of lubrication, Fault Tree Analysis, Total Productive Maintenance: Methodology and Implementation.

UNIT-III **[10]**

Job Evaluation, Wage Plan & Merit Rating

Definition and concept, Scope of industrial psychology, Individual and group psychology, Group Dynamics, Theory X and Y, Hawthorne Experiment, Methods of job evaluation, job evaluation procedure, merit rating, (performance appraisal), method of merit rating, wage and wage incentive plans, Funnel Marble theory.

Ergonomics

Objectives, Advantages, Applications of Ergonomics, Concept of fatigue, Causes of fatigue, Thermal conditions, Noise and vibration, Illumination and lighting, Hazardous working conditions, Posture and Movement, Biomedical principles, Physiological principles, Anthropometric principles, Principles for the design of visual displays, Design principles of controls.

UNIT-IV **[14]**

Location Selection and Plant Layout

Nature of Location Decision, Importance of Plant Location, Dynamic Nature of Plant Location, Choice of site for selection, , Comparison of location, Principles of Plant layout and Types, factors affecting layout, methods, factors governing flow pattern, travel chart.

Productivity and Work Study

Definition of productivity, reasons for increase and decreases in productivity. Areas of application of work study in industry. Method Study: Objectives and procedure for methods analysis, Recording techniques, Micro motion and macro-motion study: Principles of motion economy, Work Measurement: Objectives, Work measurement techniques – time study, work sampling, pre-determined motion time standards (PMTS), Determination of time standards. Observed time, basic time, normal time, rating factors, allowances, and standard time.

Text Books

1. Industrial Safety and Health Management By Ray Asfahl, C. Prentice Hall Publication.
2. Reliability & Maintenance Engineering By S.C.Mishra , New Age Publishing House
3. Handbook of Condition Monitoring By Davis, Chapmann& Hall Publication.
4. Industrial Engineering and Production Management – By M. Mahajan, Dhanpat Rai & Co.
5. Materials management & Material Handling; S. C. Sharma; Khanna Publishers

Reference Books

1. Production System, Planning, Analysis and Control – By J. L. Riggs 3rd ed. Wiley
2. Industrial Engineering and Organization Management by S K Sharma, Savita
3. Sharma, KATSON Books
4. Industrial Engineering and Management by Dr. B.Kumar Khanna Publishers.
5. Maintenance Engineering and Management; Sushil Kumar Srivastava, S. Chand Publications

6. Industrial Engineering and Production Management Martand Telsang S Chand & company.
7. Maintainance Engineering Handbook By Higgins,L.R. by McGraw Hill Publication
8. Industrial Maintainance By Garg, M.R. By S.Chand& Co
9. Industrial Engineering & Production Management By M. Mahajan ,DhanpatRai Publication

Web Resources: http://nptel.ac.in/courses

Subject: Automobile Systems								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0506**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

COURSE OBJECTIVES:

1. The purpose of this course is to impart adequate knowledge in both ways practically as well as Theoretically.
2. Imparting knowledge of various types of power-driven vehicles.
3. To familiarize the students with the fundamentals of Automotive Engine System, Chassi suspension system, braking and transmission system.
4. The students are acquainted with the location and importance of operation, maintenance and repair of all components of the various transportation vehicles.

COURSE OUTCOMES:

1. Identify the various parts of the automobile
2. Explain the working of various parts like engine, transmission, clutch, brakes.
3. Describe how the steering and the suspension systems operate.
4 Develop a strong base for understanding future developments in the automobile industry

UNIT-I **[06]**

Vehicle Classification and Layouts

Study various vehicle layouts as front engine & front wheel drive, Front engine & Rear wheel drive, Rear engine & Rear wheel drive. Four wheel drive, Classification based on controls positioning.

Performance Of Vehicle

Vehicle motion, Resistances during motion, Accelerated and constant velocity motions, Tractive force, Gradeabilty, Power required to propel vehicle, Engine characteristics, Gear ratio requirement.

Frames & Body

Types of chassis and frames, Construction of chassis and frames, Vehicular body.

UNIT-II **[12]**

Clutch

Functions Of Clutch, Desirable Qualities Of Clutch, Requirements of Clutch, Types Of Clutch, Friction Clutch, Cone Clutch, Single Plate Clutch, Multiplate Clutch, Centrifugal And Semi Centrifugal Clutch, Hydraulic Clutch, Vacuum Operated Clutch, Electromagnetic Clutch.

Transmission System

Manual transmission: sliding mesh gearbox, constant mesh gearbox, Synchromesh gearbox, Selector mechanism, 4×4 transfer case, automatic transmission: Torque converter, Free wheel unit, Epicyclical gear boxes and Continuously variable transmission.

UNIT-III **[12]**

Drive Line and Axles

Propellers shaft, Types of final drive- torque tube drive- hotchkiss drive-hypoid drive, Drive axles, Types of axle, Fully or semi-floating and three quarter floating, Dead axle, constant velocity joints, Differential, Differential lock, Limited slip differential.

Wheels and Tyres

Types of wheel, wheel dimensions, Wheel balance, Types of tyres, Desirable properties of tyre, Tread patterns of tyre, Tyre construction, Designation of tyre.

Brakes

Function and requirements of brakes, Internal expanding shoe brakes, Shoes and lining material, Leading and trailing shoe, Hydraulic braking system, Brake oils, Bleeding of brakes, Pneumatic braking system, Vacuum brakes, Exhaust brakes, Parking brake.

UNIT-IV **[12]**

Steering System

Requirements of steering, Steering system and linkages, Steering geometry, Steering ratio, Types of steering gears box- warm and wheel- warm and nut- recirculating ball- rack and pinion-cam and lever steering gearbox, Wheel alignment, Toe-in, Toe-out, Caster, Camber, Power steering systems.

Suspension System

Purpose of front and rear suspension, Types of suspension system, Coil spring, leaf spring, Torsion bars, Shock absorbers, Air suspensions, Independent suspension systems.

Text Books

1. Automobile Engineering Vol- I & II by Dr. Kirpal Singh, Standard Pub.& amp; Dist.
2. Automobile Technology by Dr. N.K.Giri, Khanna Pub.
3. Automobile Engineering-II by P .S. Gill, S K Katariya and sons publications

Reference Books

3. GBS Narang, Automobile engineering, Khanna Publishers.
4. R.K. Rajput, Automobile Engineering, Laxmi Pullications.
5. Crouse, William H., and William Harry Crouse. Automotive mechanics. Tata McGraw-Hill Education, 1982.
6. Heisler, Heinz. Advanced vehicle technology. Elsevier, 2002.

List of learning website

1. http://www.carbibles.com
2. http://www.sae.org

List of Experiments

1. Introduction to Automobile
2. To study about Clutch System.
3. To study about Transmission System
4. To study about Wheels and Tyres
5. To study about Braking System.

6. To study about Steering System.
7. To study about Suspension System.
8. Performance practical on wheel balancing.

Subject: **Technical Communication and Soft Skills**								
Program: **B.Tech. All Branches**				Subject Code: **SHO507**			Semester: **V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	0	0	0	60	0	40	0	100

Course Objectives:

- To enable students to interact with a degree of fluency and spontaneity that makes regular interaction with fluent English speakers quite possible without strain for either party.
- To understand with ease virtually everything heard or read.
- To express themselves spontaneously, very fluently and precisely, differentiating finer shades of meaning even in the most complex situations.
- To understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment).
- To communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters
- To understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in their field of specialization.

Course Content:

	Sr. No.	**Content**
Listening	1	**Listening: Cloze test**
	2	**Listening to Talks (BBC, TED) 1**
	3	**Listening to Talks 2**

Speaking	**4**	**Phonetics: Sounds & Symbols & Accent Patterns**
	5	**Vocabulary Games: Intermediate Level**
	6	**Vocabulary Games: Intermediate Level**
	7	**Building Dialogues: Situational Conversation**
	8	**Role Play**
	9	**Group Discussion**

Reading	**10**	**How to Read effectively**
	11	**Reading to Remember : SQ3R**

Writing	**12**	**Grammar Intermediate: Sentence Transformation**
	13	**Common Errors in English**
	14	**Précis Writing**
	15	**Effective Paragraph Writing**

6TH SEMESTER

B TECH MECHANICAL ENGINEERING SEMESTER –VI TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	ME0601	Operation Research	03	02	00	04	05	30	10	60	00	00	100
2	ME0602	Machine Design-I	04	02	00	05	06	30	10	60	00	00	100
4	ME0604	Internal Combustion Engine	04	00	02	05	06	30	10	60	40	60	200
5	ME0605	Refrigeration & Air Conditioning	04	00	02	05	06	30	10	60	40	60	200
3	ME0603	Total Quality Management (DE-I)	03	00	00	03	03	30	10	60	00	00	100
6	ME0606	Advanced Mechanics of Solids (DE-I)											
7	ME0614	Surface Engineering (DE-I)											
8	ME0608	Vehicle Dynamics (DE-II)	03	00	00	03	03	30	10	60	00	00	100
9	ME0609	Advanced Thermodynamics And Heat Transfer (DE-II)											
10	ME0610	Alternate Energy Sources (DE-II)											
11	ME0611	Steam And Gas Turbines (DE-II)											
12	ME0612	Advanced Manufacturing Techniques (DE-II)											
13	ME0613	Rapid Prototype & Tooling (DE-II)											
14	ME0607	Finite Element Method (DE-II)											
15	SH0607	Advanced Technical Communication And Soft Skill	01	00	00	00	00	00	00	00	00	00	100
TOTAL			**20**	**04**	**08**	**25**	**30**	**180**	**60**	**360**	**80**	**120**	**900**

Subject: Operation Research								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0601**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	24/60	00	16/40	00	100

Course Objective

1. To introduce and formulate optimization problems;
2. To understand and apply the concept of optimality criteria for various type of optimization problems;
3. Solve various constrained and unconstrained problems in single variable as well as multivariable
4. apply the methods of optimization in real life situation

Course Outcomes

1. Identify and develop operational research models from the verbal description of the real system.
2. Understand the mathematical tools that are needed to solve optimization problems.
3. Use mathematical software to solve the proposed models.
4. Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Content

UNIT-I **[12]**

Introduction to Operation Research

Definition, characteristics, necessity, scope, phases, models, applications, advantages, limitations of OR

Linear Programming

Introduction, Assumption, Mathematical Model, Formulation of LPP, Graphical solution of LPP. Simplex method, Big-M method, Two-phase method, degeneracy, Special cases in LPP, Duality.

UNIT-II **[14]**

Transportation Model

Introduction, Assumption, Mathematical Model, Formulation of TP, Types of Transportation problem. Methods of finding basic feasible solutions – Northwest corner rule, row minima method, column minima method, least cost method and Vogel's approximation method, Optimality test – Stepping stone method and MODI method, Degeneracy in TP.

Assignment Model

Introduction, Assumption, Mathematical Model, Formulation of Assignment model, Hungarian method for optimal solution, Solving unbalanced problem, Traveling salesman problem and assignment problem.

UNIT-III **[10]**

Games Theory

Introduction, Competitive games, rectangular game, saddle point, minimax and max min principle, method of optimal strategies, value of the game, solution of games with saddle points, dominance principle, rectangular games without saddle point – mixed strategy for 2 X 2 games.

Replacement Models

Introduction, Need of replacement, replacement of Items that deteriorate whose maintenance costs increase with time without change in the money value, replacement of items that fail suddenly, individual replacement policy, group replacement policy.

UNIT-IV **[14]**

Network Analysis in Project Management

Introduction, Network diagram, event, activity, defects in network, PERT & CPM, float in network, variance and probability of completion time, project cost- direct, indirect, total, optimal project cost by crashing of network

Inventory models

Introduction, Need of Inventory, Inventory costs, ABC Analysis, Models with deterministic demand – (a) Classical EOQ model, (b) EOQ with price breaks ,(c) build up model for production runs, (d) Inventory model with planned shortages

Reference Books

1. Operation Research – P.K. Gupta & D.S. Hira, S.Chand & Company Ltd, New Delhi
2. Quantitative Techniques in Management – N.D. Vohra , Tata McGraw Hill, New Delhi
3. Operation research – P. Rama Murthy, New Age, New Delhi.
4. Operation Research – Hamdy A. Taha, Pearson Education.
5. J.K. Sharma, "Operations Research Theory and Practice", McMillan India. Ltd.New Delhi
6. H M Wagher, "Principles of operation Research (with Applications to Managerial Decisions)", Prentice Hall of India, New Delhi
7. Ackoff, Churchaman, Arnoff, "Principle of Operations Research", Oxford IBH, New Delhi.

Web Resources

1. http://www.nptel.ac.in/courses/110106059/
2. http://nptel.ac.in/video.php?subjectId=112106134

Subject: Machine Design - I								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0602**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	2	0	5	24/60	-	16/40	-	100

Course Objectives

1. To develop an ability to design a mechanical component subjected to fluctuating loads.
2. To develop an ability to design mechanical springs, clutch, brakes and pressure vessels.
3. To develop an ability to design coil springs (compression, tension and torsion) under various loading conditions.

Course Outcomes

1. Able to estimate the fatigue strength and fluctuating loads that will cause failure in real parts using the Soderberg and Goodman techniques.
2. Able to determine suitable material and size for structural components in machines, including effects of fatigue and stress concentration.
3. Able to analyze and design components with non-uniform cross sections.
4. Able to analyze the stress and strain in springs, thick and thin cylinders and clutch plates.

Content

UNIT-I [12]

Design Against Fluctuating Loads

Stress concentration, reduction of stress concentration effects, fluctuating stresses, fatigue failure, endurance limit, notch sensitivity, reversed stresses- design for finite and infinite life, cumulative damage in fatigue, Soderberg and Goodman diagrams, modified Goodman diagrams, fatigue design under combined stresses.

UNIT-II **[12]**

Mechanical Springs

Helical springs – stress and deflection equation, spring materials, design against static load and fluctuating load, optimum design of helical springs, helical torsion springs, multi-leaf springs, nipping of leaf spring, and shot penning.

UNIT-III **[16]**

Clutches

Classification, positive clutches, friction clutches, material for friction surfaces, types of friction clutches, considerations in designing a friction clutch, single disc or plate clutch, design of a disc or plate clutch, multiple disc clutch, cone clutch and centrifugal clutch.

Brakes

Types of brakes, design of band brake, pressure between band and drum, average pressure, heat generation and dissipation. Band and Block brake, Block brake.

UNIT-IV **[16]**

Cylinders and Pressure Vessels

Thin cylinders, change in the volume of cylindrical shell due to internal pressure, thin spherical shell subjected to internal pressure, thin spherical shell- change in dimensions, thick cylinders, Lame's equation, Clavarino's and Birnie's equations, compound cylinders, cylinder heads and cylinder plates

Text Books

1. V.B. Bhandari, Design of Machine Elements, Tata McGraw Hill Publishing Co
2. Design of Machine Elements, M.F.Spotts, T.E.Shoup, L.E.Hornberger, S.R.Jayaram and C.V. Venkatesh, Pearson Education
3. JoshephShighly, Mechanical Engineering Design, Tata McGraw Hill Book Co.
4. FarazdakHaideri, Machine Design - Volume 1, 2, NiraliPrakashan
5. "Machine Design", Dr. S.S. Wadhwa, Dhanpat rai & Co.
6. "Machine Design", P.C.Sharma& Aggarwal, Katariya& Sons

Reference Books

1. Joseph Shigley, Charles Mischke, Thomas Brown, Standard Handbook of Machine Design, McGraw-Hill Publishing Co
2. Norton and Norton, Machine Design: An Integrated Approach, Pearson Publication

Web Resources

1. www.nptel.ac.in
2 www.learnengineering.org
2. http://www.freestudy.co.uk/

Subject: Total Quality Management (DE-I)								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0603**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1.Understand the philosophy and core values of Total Quality Management (TQM)

2.Determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization;

3.Apply and evaluate best practices for the attainment of total quality.

Course Outcomes

1. Select and apply appropriate techniques in identifying customer needs, as well as the quality impact that will be used as inputs in TQM methodologies;
2. Measure the cost of poor quality and process effectiveness and efficiency to track performance quality and to identify areas for improvement;
3. Understand proven methodologies to enhance management processes, such as benchmarking and business process reengineering;
4. Choose a framework to evaluate the performance excellence of an organization, and determine the set of performance indicators that will align people with the objectives of the organization..

Content

UNIT-I **[06]**

Introduction

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT-II **[10]**

TQM Principles

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT-III **[15]**

TQM Tools & Techniques

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT-IV **[21]**

Quality Systems

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

Six Sigma and Lean Manufacturing

Introduction to six sigma, elements of six sigma, organization of six sigma, six sigma methodology, six sigma technical tools, Introduction to lean manufacturing, benefits of lean manufacturing, various concepts of lean manufacturing.

Text Books

1. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia,3rd Edition, Indian Reprint (2006)
2. R. Panneerselvam, P. Sivasankaran, Quality Management, PHI learning

Reference Books

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S., “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 200UNIT III
3. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006
4. Janakiraman, B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.

Web Resources: www.nptel.ac.in

Subject: Internal Combustion Engine								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0604**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	0	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. To make students familiar with the combustion and thermodynamic analysis of a spark ignition engine and compression ignition engine.
2. To understand about actual otto and diesel cycles.
3. To provide knowledge of combustion process in the combustion chamber.

Course Outcomes

1. Understand automobile engine working, valve timing and associated systems such as lubricating system, cooling system, fuel feed system, ignition system etc., their necessity, requirements, construction details, different types and their working
2. Explain concept of combustion in Spark ignition engine and Compression ignition engine, Pressure Vs crank angle diagrams, Knocking, Detonation and pre-ignition
3. Analyze the performance of I.C. Engine

Content

UNIT-I **[09]**

Introduction

Applications, actual working of IC engines, valve and port timing diagrams.

Fuel Air Cycles, Actual Cycles and Their Analysis:

Factors considered and assumptions made for fuel–air cycles, dissociation, comparison of air standard and fuel air cycles, effect of operating variables on cycle analysis, difference between actual cycle and fuel air cycle for SI and CI engines

UNIT-II **[12]**

Combustion in S.I. Engines

Stages of combustion, ignition lag and the factors affecting the ignition lag, flame propagation and factors affecting flame propagation, abnormal combustion and knocking in SI engines, factors affecting knocking, effects of knocking, control of knocking, combustion chambers for S.I. engines.

Combustion in C.I. Engines

Stages of combustion, delay period /ignition lag and the factors affecting it, detonation in C.I. engines, factors affecting detonation, controlling detonation, combustion chambers for C.I. engines.

Properties of I.C. Engine Fuels

Desirable properties of I.C. engine fuels, required qualities of S.I and C.I engine fuels, rating of S.I and C.I. engine fuels, HUCR, dopes/additives for S.I. & C.I. engines, use of alternate fuels like CNG, LNG, LPG, vegetable oils, biodiesel, alcohol, biogas and hydrogen for IC engines.

UNIT-III **[12]**

Engine Testing

Aims of engine testing, measurement of indicated power, brake power, friction power, speed, air consumption, fuel consumption. IC engine efficiencies, specific output, specific fuel consumption, heat balance sheet, performance characteristics of SI and CI engines, testing of IC engines as per Indian standard 10001.

Supercharger

Objects, types of superchargers. Supercharging of SI and CI engines, effects of supercharging, supercharging limits, methods of supercharging, turbo charging.

Emission Control

Emission of pollutants from SI & CI engines, control of emissions from SI and CI engines, measurement of pollutants in exhaust gases, emission (Euro &Bharat stage) norms. Working principle of Stirling and Wankle.

UNIT-IV **[15]**

Variable Specific Heats

Reasons for variation of specific heats of gases change of internal energy and enthalpy during a

process with variable specific heats, isentropic expansion with variable specific heats, effect of variable specific heats on air standard cycles of Otto and diesel cycles.

Fuel Supply Systems for S.I Engines

Fuel supply system for SI engines, properties of air-petrol mixture, mixture requirement for different loads and speeds, simple carburetor and its working, calculation of air-fuel ratio, types of carburetors, limitations of a single jet carburetor, modern carburetors, problems in carburetors, altitude compensation, gasoline injection in SI engines, mpfi system for modern automobile engines.

Fuel Supply Systems for C.I Engines

Fuel supply systems for C.I. engines: Requirement of ideal injection system, types of injection systems, fuel pumps and injectors, types of nozzles, spray formation, quantity of fuel and size of nozzle orifice.

Text Books

1. A course in internal combustion engines by V.M.Domkundwar, Dhanpat rai &Co.(p) ltd, New Delhi
2. Internal combustion engines by Mathura & Sharma, Dhanpat rai & Sons, New Delhi.
3. Internal combustion engines by V.Ganeshan, Tata McGraw hill pub .co .ltd., New Delhi.

Reference Books

1. Internal combustion engines by Ramalingam Scitechpub. india Pvt. Ltd., Chennai.
2. Internal combustion engines by H.N.Gupta, PHI Learning, NewDelhi.
3. Internal combustion engines by B.L..Singhal Tech-maxpublications,Pune.

Web Resources

1. www.nptel.com
2. www.howstuffworks.com

List of Experiments

1. To study about Internal Combustion engine.
2. To study about Alternative fuels for I.C engine
3. To study about Fuel supply system for S.I. Engine
4. To Study fuel supply system for C.I Engine.

5. To study about Supercharging and Turbocharger
6. To study about combustion in S.I & C.I Engines.
7. The emission from I.C. engine.
8. Performance practical on Single Cylinder Diesel engine test rig.
9. Performance practical on two stroke single cylinder Petrol engine test rig.
10. Performance practical Multi cylinder Petrol engine test rig using throttle system
11. Performance practical Multi cylinder Petrol engine test rig using MPFI system
12. Performance practical on Multi cylinder Diesel engine test rig

Subject: Refrigeration & Air Conditioning								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0605**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
04	00	02	05	24/60	24/60	16/40	16/40	200

Course Objectives

1. To identify various methods of Refrigeration.
2. To understand various applications of Refrigeration & Air Conditioning.
3. To understand the importance of various equipments used in Refrigerator & Air Conditioning Systems.

Course Outcome

1. To understand the fundamental concepts of Refrigeration & Air Conditioning Systems.
2. To analyze different Refrigeration cycles.
3. Compare the performance of different refrigerants.
4. Estimate Heating & Cooling Loads for various applications.

Content

UNIT-I **[10]**

Introduction Of Refrigeration & Air Conditioning

Second law of thermodynamic for Refrigeration and Air conditioning, Working principle of R&AC. unit of refrigeration and C.O.P. – Mechanical refrigeration – types of ideal cycles of refrigeration, Necessity and applications

Air-Refrigeration Cycle

Air refrigeration: Bell Coleman cycle - open and dense air systems, Bootstrap air refrigeration system, types of air cycles, advantages and is advantages.refrigeration systems used in air crafts and problems.

UNIT-II **[12]**

Vapour Compression System

Working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts, actual cycle influence of various parameters on system performance – use of p-h charts – numerical problems.

Vapour Absorption Refrigeration System

Comparison of VCRS & VARS , Advantages of VARS Refrigeration Systems, Types of VARS Systems (practical water -NH3 cycle Li–Br system) and its working, Electrolux Refrigeration Systems.

UNIT-III **[14]**

Refrigerants

Development, classification, designation of refrigerants, secondary refrigerants, future industrial refrigerants.

Psychrometry – Psychrometric Processes

Determination of condition of air entering conditioned space. Air conditioning systems – summer, winter and year-round-year air conditioning systems -- central and unitary systems. Requirement of air conditioning – human comfort – comfort chart and limitations – effective temperature – factors governing effective temperature – design considerations.

Air-Conditioning Systems

Classification, system components, all air, all water, air water systems, room air conditioners, packaged air conditioning plant, central air conditioning systems, split air conditioning systems.

UNIT-IV **[14]**

Refrigeration & Air Conditioning System Components

Compressors, condensers, expansion devises, evaporators its types construction and working, comparison and selection, refrigeration piping accessories and controls, thermal insulation properties and classification, thickness of insulation.

Air Conditioning Equipments And Control System

Air filters – humidifiers – fan – blowers control systems for temperature and humidity – noise control. Installation and charging of refrigeration unit, Testing for leakage, Cause for faults and rectification.

Cooling Load Calculation&Thermal Insulation For Air-Conditioning Systems

Various heat sources contributing heat load – solar load -equipment load -infiltration air loadFactors affecting the thermal conductivity, types of insulating materials, reflective insulating blinds, heat transfer through insulation used for air-conditioning, economical thickness of insulation, few insulated systems, importance of relative humidity for the selection of insulation.

Reference Books

1. Rajput R.K “Refrigeration and air conditioning”; S. K. Kataria & Sons; Delhi, 2009
2. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1983
3. Arora. C.P., Refrigeration and Air Conditioning, Tata McGraw-Hill New Delhi, 1988
4. S C Arora & S Domkundwar, ‘Refrigeration and Air-Conditioning’ Dhanpat Rai Publication, 2009
5. Ahmadul Ameen "Refrigeration and Air Conditioning", Prentice Hall of India Pvt. Ltd. 2010
6. Ramesh Arora ,” Refrigeration and Air-conditioning”, Prentice Hall of India, 2010

Web resources

1. http://nptel.ac.in/courses/112105128
2. https://swayam.gov.in/search?keyword=Refrigeration%20and%20air-conditioning

List of Experiments

1. Vapour Absorption Refrigerator
2. Mechanical Heat Pump
3. Refrigeration Test Rig
4. Air Conditioning Test Rig
5. Ice Candy maker
6. Force Draught Cooling Tower

Subject: Advanced Mechanics of Solids (DE-I)								
Program: B.Tech. Mechanical Engineering				Subject Code: ME0606			Semester: VI	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To understand the theory of elasticity including strain/displacement and Hooke's law relationships
2. To analyze solid mechanics problems using classical methods and energy methods.
3. To solve torsion problems in bars and thin walled members

Course Outcome

1. Apply non-linear solid mechanics theory to solve advanced practical problems in structural analysis, machine design and material processing.
2. Evaluate the influence of non-linearity on the behaviour of engineering materials and its impact in various mechanical engineering scenarios and contexts.

Content

UNIT-I **[08]**

Review of basic concepts and equations in mechanics, Classification of materials, Outline of general techniques to solve boundary value problems

Introduction to tensors, Representation of tensors, Gradient and related operators, Divergence theorem

UNIT-II **[10]**

Concept of traction, Cauchy's stress theorem, Postulate of Cauchy stress tensor, Traction on arbitrary planes, Extreme normal and shear traction, Octahedral shear stress, Other stress measure - Engineering stress.

Derive equilibrium equations in Cartesian and cylindrical polar coordinates**.**

UNIT-III **[10]**

Restrictions on constitutive relations, General relationship between Cauchy stress and Cauchy Green strain for isotropic materials, General Hooke's law and its reduction for isotropic and orthotropic materials

UNIT-IV **[14]**

Displacement method, Stress method, Airy's stress functions for plane stress and strain problems, Uniaxial Tension, Thick-walled annular cylinder subjected to uniform boundary pressure,

Pure bending, bending due to uniform transverse loading and bending due to transverse sinusoidal loading of a beam.

Formulation of the BVP for torsion of beams with solid cross section - warping function and Prandtl stress function approach.

Reference Books

1. L.S. Srinath, "Advanced Mechanics of Solids" Tata McGraw Hill, 2007.
2. A.R. Ragab, and S.E. Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press, 1999.
3. M.H. Sadd, "Elasticity: Theory, Applications and Numerics", Academic Press, 2006.

Web Resources: www.nptel.ac.in

Subject: Finite Element Method (DE-II)								
Program: B.Tech. Mechanical Engineering				Subject Code: ME0607			Semester: VI	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	-	16/40	-	100

Course Objective

1. Understand the general steps of finite element methods.
2. Understand the basic finite element formulation techniques.

Course Outcomes

1. Be able to derive equations in finite element methods for 1D, 2D and 3D problems.
2. Be able to formulate and solve basic problems in heat transfer, solid mechanics and fluid mechanics.
3. Be able to write computer program based on finite element methods.
4. Be able to use commercial software, to solve basic engineering problems in heat transfer, solid mechanics and fluid mechanics.

Content

UNIT-I **[12]**

Introduction

Basic Concepts of Finite Element Analysis, Introduction to Elasticity, Steps in Finite Element Analysis

Finite Element Formulation Techniques

Virtual Work and Variational Principle, Galerkin Method, Finite Element Method: Displacement Approach, Stiffness Matrix and Boundary Conditions.

UNIT-II **[10]**

Element Properties

Natural Coordinates, Triangular Elements, Rectangular Elements, Lagrange and Serendipity Elements, Solid Elements, Isoparametric elements and Formulation, Stiffness Matrix of Isoparametric Elements

Analysis of Truss & Beams

Stiffness of Truss Members, Analysis of Truss, Stiffness of Beam Members, Finite Element Analysis of Continuous Beam

UNIT-III **[12]**

Analysis of Frame Structures

Plane Frame Analysis, Analysis of Grid and Space Frame.

FEM for Two Dimensional Solids

Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements, Numerical Evaluation of Element Stiffness, Computation of Stresses, Geometric Nonlinearity and Static Condensation, Axisymmetric Element, Finite Element Formulation of Axisymmetric Element

UNIT-IV **[14]**

Thermal and Fluid Problems

Steady state heat transfer: Element formulations, treatment to boundary conditions with application to 1-D heat conduction, heat transfer through thin fins; Potential flow problems

Dynamic Problems

Formulation of dynamic problems, consistent and lumped mass matrices for 1-D and 2-D element, Solution of eigenvalue 1-D problems: Transformation methods, Jacobi method, Vector Iteration methods, subspace iteration method.

Reference Books

1. T. Chandrupatla and A. G. Belegundu, “Introduction to Finite Elements in Engineering”, Prentice Hall Inc., 2002
2. Rao S S, “The Finite Element Method in Engineering” Butterworth-Heinemann, 2010
3. J. N. Reddy, “Introduction to the Finite Element Method”, McGraw-Hill Education, 2005

4. Zienkiewicz & Taylor, “The Finite Element Method”, 5/e, Butterworth-Heinemann, 2000
5. Thompson, “Introduction to the FEM : Theory, Programming and Applications”.
6. P.Seshu, “Text Book of Finite Element Analysis”, Prentice Hall of India Pvt. Ltd. New Delhi, 2007.M.H. Sadd, "Elasticity: Theory, Applications and Numerics", Academic Press, 2006.

Web Resources: www.nptel.ac.in

Subject: Vehicle Dynamics (DE-II)								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0608**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course objective

1. To understand the terminology of road vehicle dynamics, stability and handling.
2. To introduce the fundamentals of vehicle dynamics and the performance indices and evaluation criteria of vehicles and is implications on fuel economy.
3. To analyze the influence of vehicle configuration such as bluff body and streamline body and design parameters on vehicle performance.
4. To understand to aerodynamic shape analysis of vehicles.

Course outcomes

1. Able to sketch the various low drag body profiles.
2. Able to identify the various forces and loads and performance under acceleration, ride and braking.
3. Able to apply vehicle design performance criteria and how to use the criteria to evaluate vehicle dynamic response.
4. Able to analyze the vehicle directional stability and roll behavior.

Content

UNIT-I **[12]**

Introduction to vehicle dynamics

Forces, Dynamic Axle loads, Static loads, low speed acceleration, Grade Loads, Acceleration Performance: Power limited acceleration; Traction limited acceleration, Braking Performance.

Viscous air flow fundamentals

boundary layers, skin friction, surface friction drag, venture, air streamlines, speed and pressure condition over the upper profile of moving car, laminar and turbulent boundary layer, flow separation and reattachment

UNIT-II **[12]**

Aerodynamic drag

Pressure drag. Air resistance opposing the motion of vehicle, after flow wake, drag coefficient for various shapes of body, base drag, The concept of bluff body; Analysis of aerodynamic drag force; types of drag force; drag coefficient of cars; strategies for aerodynamic development; low drag profiles for vehicle.

Aerodynamic shape analysis

Front and modification; front and rear wind shield angle; boat tailing; hatch back, fast back and square back; dust flow patterns at the rear; effect of gap configuration

UNIT-III **[12]**

Aerodynamic lift

Vehicle lift, lift coefficient, upper body floor aerodynamics, aerofoil lift and drag, front end nose shape, Reducing Aerodynamic Drag and Fuel Consumption, profile edge rounding, bonnet slop, windscreen rake, roof and side cambering, rear side panel taper, rear end upper taper, tail extension, aerodynamics lift controls, after body drag.

UNIT-IV **[12]**

Commercial vehicle aerodynamics fundamentals

Effect of rounding sharp front cab body edges, sharp anr round upper windscreen leading edges, pressure distribution, body roof height step, commercial vehicle drag reducing devices: deflectors, yaw angle, corner vanes, cab to trailer body gap.

Text Books

1. Hucho, W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 1997.Rao S S, “The Finite Element Method in Engineering” Butterworth-Heinemann, 2010
2. J.Powloski - “Vehicle Body Engineering” - Business books limited, London – 1969
3. Ronald.K.Jurgen - “Automotive Electronics Handbook” - Second edition- McGraw-HillInc., -1999.
4. Heinz Heisler, “Advanced. Vehicle Technology” SAE international second edition 2002
5. Fundamentals of Vehicle Dynamics – Thomas D. Gillespie, 2013, Society of Automobile Engineers Inc., ISBN: 978-1560911999

Reference Books

1. Mechanics of Road Vehicles – W. Steed, Ilete Books Ltd. London
2. Vehicle dynamics and control by Rajesh Rajamani , Springer publication
3. Mechanics of Road Vehicles – W. Steed, Ilete Books Ltd. London

Web Resources: www.nptel.com

Subject: Advanced Thermodynamics and Heat Transfer (DE-II)								
Program: B.Tech. Mechanical Engineering				Subject Code: ME0609			Semester: VI	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
3	0	0	3	24/60	0	16/40	0	100

Course Objective

1. To understand the theory and applications of classical thermodynamics, thermodynamic properties, equations of state.
2. Understand the nature and role of the following thermodynamic properties of matter: internal energy, enthalpy, entropy, temperature, pressure and specific volume.
3. The course is prepared to provide the detailed understanding of laws and principles of Thermodynamics and Heat Transfer

Course Outcome

1. Apply entropy principle to various thermal engineering applications
2. Apply the concept of second law efficiency and exergy principle to various thermal engineering applications
3. Analyze steady state and transient heat conduction problems of real life Thermal systems
4. Analyze extended surface heat transfer problems and problems of phase change heat transfer like boiling and condensation
5. Analyze radiation heat transfer problems of various thermal systems

Content

UNIT-I **[06]**

Radiation

Radiation Intensity, Blackbody Radiation, Emission from Real Surfaces Radiation: Combine with Conduction and Convection, Radiation Exchange with Participating Media, Radiative exchange and overall

UNIT-II **[08]**

Entropy

A Measure of Disorder: Increases of entropy principle and its application, Tds relation, entropy change of solid, liquid and ideal gas, entropy transfer with heat transfer, entropy generation in open and closed system , entropy balance Exergy: A Measure of Work Potential: Exergy transfer by heat, work & mass, decrease of exergy principle and exergy destruction, applications of Gouy–Stodola theorem, exergy balance for steady flow and closed processes, second law efficiency Law of Corresponding States.

UNIT-III **[11]**

Basics of Heat Transfer-Conduction

Conduction Rate Equation, Heat Diffusion Equation, Boundary and Initial Conditions, General conduction Equation, Conduction with Heat Generation, Extended Surfaces with Uniform and Non Uniform Cross Sections, Two Dimensional Steady State Conduction: Mathematical, Graphical and Numerical Analysis of Two Dimensional Heat Conduction Unsteady State Conduction: Lumped Parameter Analysis, Numerical Solutions, Heisler and Semi Analytical Analysis.

UNIT-IV **[11]**

Convection

Different Types of Flow and Boundary Layers, Flow Through Tubes, Flow Over Flat Plates, Cylinders, Spheres and Tube Blanks, Free Convection on Flat Surfaces, Cylinders, Spheres and Enclosed Spaces Heat Transfer during Phase Transformation: Boiling: Pool Boiling and its Correlations, Forced Convection Boiling, Condensation: Laminar and Turbulent Film Contestation, Film Condensation in Radial Surfaces and Horizontal Tubes, Heat Pipe.

Text Books

1. Thermodynamics – An Engineering Approach by Yunus Cengel & Boles, McGraw-Hill Publication
2. Engineering Thermodynamics by P.K. Nag, McGraw-Hill , New Delhi

Reference Books

1. Fundamentals of Thermodynamics by Sonntag, Borgnakke & Van Wylen, John Wiley & Sons
2. Fundamentals of Heat and Mass Transfer, by Incropera, Dewitt, John Wiley & Sons (Asia) Pvt. Ltd.
3. Heat Transfer by J P Holman, McGraw-Hill Publication, New Delhi
4. A Heat Transfer Textbook by J H Lienhard, Phlogiston Press

Web Resources: http://nptel.iitm.ac.in/courses.php

Subject: Alternate Energy Sources (DE-II)								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0610**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To acquire knowledge about alternate energy sources.
2. To learn how to harness alternate energy and its applications.
3. To learn about Biogas production and its usage in rural area.

Course Outcomes

1. Students will be gaining knowledge about the various alternate energy sources which are clean energy.
2. Subject will through light on usage of alternate energy in daily life as well for agriculture and industry purpose.

Content

UNIT-I **[08]**

Introduction

Energy forms, World's and India's production and reserves of energy, Global and national energy scenarios, Need for alternate sources.

Solar Energy

Solar geometry, solar radiation at the earth's surface, sunrise, sunset and day length, Instruments for solar radiation measurements, estimation of average solar radiation, Solar collectors material, types and performance analysis, Collector efficiency, overall loss coefficient, collector efficiency factor, solar air heaters- types, performance, applications, focusing collector and its types, tracking, performance, non-focusing type collectors, CPC, optical losses.

[08]

UNIT-II

Applications of Solar Energy

Solar water heaters, heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and A/C, solar pond, solar power plant, heliostat, solar furnace, solar chimney power plant.

Wind Energy

Power in wind, power coefficient, wind mills-types, design consideration, performance advantages and disadvantages, Applications, wind energy development in India.

[10]

UNIT-III

Ocean Energy

Introduction, OTEC principle, open cycle OTEC system, closed cycle, hybrid cycle, Energy from tides, estimation of tidal power, tidal power plants, single basin, double basin, , advantages and imitations, Wave energy, wave energy conversion devices, advantages and disadvantages, small scale hydro power

Geothermal Energy

Introduction, Vapor dominated system, liquid dominated system, hot dry rock resources, magma resources, advantages and disadvantages, applications, geothermal energy in India: prospects

[10]

UNIT-IV

Biogas and Biomass

Types of biogas plants, biogas generation, factors affecting biogas generation, , advantages and disadvantages applications, scope of biogas energy in India, biomass energy, energy plantation, gasification, types and application of gasifiers

MHD Power Plant

Principle Of MHD Power Generation, Open Cycle Plant, Closed Cycle Plant, Advantages Of MHD Plants.

Text Books

1. Non- Conventional Energy Source by G. D. Rai, Khanna Pub.
2. Solar Energy by S. P. Sukhatme, Tata McGraw Hill Pub

Reference Books

1. Non conventional energy resources by B. H. Khan Tata McGraw Hill Pub

2. Principles of Solar Energy / Frank Krieth& John F Kreider John Wiley &sons, NewYork.
3. Solar Energy: Fundamentals and Applications by H.P. Garg & Jai Prakash,Tata McGraw Hill
4. Solar Engineering of Thermal Processes by J.A. Duffic and W.A.Beckman,John Wiley & sons, New York.
5. Alternate energy sources and application by N.K .GiriKhanna Publication
6. Non conventional energy sources by Raja et.al. Scitech Publications Chennai

Web Resources:

1. www.nptel.com
2. www.bee.gov.in

Subject: Steam and Gas Turbine (DE-II)								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0611**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
03	00	00	03	24/60	00	16/40	00	100

Course Objective

1. The course is designed to give fundamental knowledge of construction and working of various types of turbines and their components i.e. steam turbine, gas turbine, nozzles etc.

Course Outcomes

1. Analyse thermodynamic cycles of steam turbine and understand construction, working and significance of its various components
2. Analyse thermodynamic cycles of gas turbine power plant and jet propulsion systems

Content

UNIT-I **[08]**

Steam Nozzles

Types of nozzles, velocity of steam, discharge through nozzle, critical pressure ratio and condition for maximum discharge, physical significance of critical pressure ratio, nozzle efficiency

UNIT-II **[10]**

Steam Turbine

Principle of operation, types of steam turbines, compounding of steam turbines, impulse turbine velocity diagram, calculation of work, power and efficiency, condition for maximum efficiency, Reaction turbines –velocity diagram, degree of reaction, reheat factor, governing of steam turbine –throttle, nozzle and bypass governing, Methods of attachment of blades to turbine rotor, Labyrinth packing, Losses in steam turbine, Special types of steam turbine-back pressure, pass out and mixed pressure turbine

UNIT-III **[10]**

Gas Turbine

Classification, open and closed cycle, gas turbine fuels, actual Brayton cycle, optimum pressure ratio for maximum thermal efficiency, work ratio, air rate, effect of operating variables on the thermal efficiency and work ratio, and air rate, simple open cycle turbine with regeneration, reheating and Intercooling, Combined steam and gas turbine plant, requirements of combustion chamber, types of combustion chambers **.**

[08]

UNIT-IV

Gas Dynamics and Jet Propulsion

Fundamentals of gas dynamics, energy equation, stagnation properties, isentropic flow through nozzle and diffusers, Introduction to shock waves, introduction to jet propulsion, advantages and disadvantages of jet propulsion – turbojet engine with and without after burner, turboprop, ram jet, pulse jet, rocket engines – operation, solid and liquid propellants

Texts Books

1. Power Plant Engineering, P.K. Nag, McGraw-Hill Education
2. Steam & Gas turbines, R. Yadav, Central publishing House, Allahabad.

Reference Books

1. Power Plant Engineering, R. K. Hegde, Pearson India Education
2. Gas Turbines, V. Ganeshan, McGraw Hill Education
3. Thermal Engineering, R.K.Rajput, Laxmi Publication
4. Steam Turbine Theory and Practice, William J. Kearton, CBS Publication
5. Gas Turbines, Cohen & Rogers, Pearson Prentice Hall

Web Resources

1. http://nptel.ac.in/courses/112104117/18
2. http://nptel.ac.in/courses/112104117/4
3. http://nptel.ac.in/courses/112104117/17

Subject: Advanced Manufacturing Techniques (DE-II)								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0612**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objective

1. Machining principles and processes in the manufacturing of precision components and products that use conventional, nonconventional, and surface engineering technologies;
2. A basic understanding of the machining capabilities, limitations, and productivity of advanced manufacturing processes.

Course Outcomes

1. Apply the working principles and processing characteristics of ultra-precision machining, high-speed machining methods, and nontraditional machining to the production of precision components;
2. Determine the quality and surface integrity of products treated by surface engineering processes

Content

UNIT-I **[04]**

Introduction

Trends in modern manufacturing, characteristics and classification of modern manufacturing methods, consideration in the process selection.

Additive Process

Introduction to additive manufacturing processes, classification, and laminated object manufacturing processes, adhesive manufacturing processes, digital manufacturing processes.

[10]

UNIT-II

Thermal metal removal processes

Electro-discharge machining (EDM), working principle, process description, process capabilities, power circuit, mechanism of metal removal, selection of tool electrode and dielectric fluid, limitation and application. Wire cut electro-discharge machining, powder mixed electro discharge machining process.

Laser beam machining (LBM), working principle, types of Laser, machining application of Laser, mechanism of metal removal, shape and material application and limitation.

Electro-beam machining (EBM), generation and control of Electro-beam, EBM systems, process analysis and characteristics, of processes, mechanism of metal removal, shape and material application and limitation.

Plasma Arc machining (PAM), and Iron beam machining: working principle, analysis and characteristics, of process, , mechanism of metal removal, shape and material application and limitation.

[12]

UNIT-III

Mechanical Processes

Introduction, principle, process, description, process capabilities, material removal mechanism, parametric analysis, tool design, limitation and applications of Ultrasonic machining (USM), Abrasive Jet Machining (AJM), Water Jet Machining (WJM), and Abrasive water jet machining (AWJM).

[14]

UNIT-IV

Electrochemical & Chemical Processes

Fundamental principle, process description, process capabilities, mechanism of metal removal, surface finish and accuracy, limitation and applications of ECM, Electrochemical Grinding (ECG), Electrochemical deburring, Electrochemical Honing and chemical machining processes.

Hybrid Machining Processes

Concept, classification, process capabilities and applications of various hybrid machining methods based on USM, EDM and ECM etc.

Micromachining Processes

Introduction to micro machining processes, material removal mechanism and process capability of micro machining methods like micro-turning, micro-milling, micro-drilling, micro EDM, micro WEDM, micro ECM, etc. Ultra-precision machining, electrolyte in process dressing and grinding.

Texts Books

1. "Advanced Machining Processes", V K Jain, Allied Publishers
2. "Non Conventional Machining", P K Mishra, Institution of Engineers Text Book Series
3. "Non Traditional Machining", Bennedict G F, Marcel Decker

Reference Books

1. "Modern Manufacturing Processes", Pandey & Sha, Prentice Hall
2. "Production Technology" HMT, Tata McGraw Hill Publication

Subject: Rapid Prototyping and Tooling (DE-II)								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0613**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objective

1. Participants will study topics fundamental to rapid prototyping and automated fabrication, including the generation of suitable CAD models
2. The rapid prototyping process will be illustrated by the actual design and fabrication of a part.

Course Outcomes

1. Describe the current available rapid prototyping systems, their fundamental operating principles, and their characteristics
2. Describe complementary, secondary fabrication processes commonly used with the above rapid prototyping systems
3. Select the appropriate fabrication technology, or technologies, for a given prototyping task

Content

UNIT-I **[05]**

Introduction

Need for time compression in product development, Product development conceptual design, Development, Detail design, Prototype, Tooling, Applications of RP

[08]

UNIT-II

Stereo Lithography Systems

Principle, Process parameters, Process details, Machine details, Applications.

[10]

UNIT-III

Laser Sintering Systems

Principle, Process parameters, Process details, Machine details, Applications.

Fusion Deposition Modeling

Principle, Process parameters, Process details, Machine details, Applications.

[17]

UNIT-IV

Laminated Object Manufacturing

Principle, Process parameters, process details, Machine details, Applications.

Laser Engineering Net Shaping (LENS)

Ballistic Particle Manufacturing (BPM), Principle, Introduction to rapid tooling, Direct and indirect method, Commercial software's for RP, STL file generation.

Rapid tooling techniques (vacuum casting, DMLS, etc.)

Text Books

1. D.T. Pham and S.S Dimov, Rapid manufacturing, Springer -Verlag, London, 2001.
2. Chua Chee Kai, Leong Kah Fai, Lim Chu -Sing, Rapid Prototyping: Principles and Applications, 2 nd edition, World Scientific, 2003, ISBN: 9812381201.

References

1. Terry wohlers, Wohlers Report 2007, Wohlers Associates, USA, 2007.
2. Kenneth G. Cooper, Rapid Prototyping Technology: Selection and Application, CRC Press, 2001.
3. A. Ghosh, Rapid Protopyping: A Brief Introduction, Affiliated East West Press, 2006.

Web Resources: www.nptel.ac.in

Subject: Surface Engineering (DE-I)								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0614**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To develop fundamental understanding and the role of materials to allow surface selection for mechanical contact surfaces.

Course Outcomes

1. Students will be able to understand failure micro mechanisms occurring for different service conditions.
2. Students will be able to relate the micro mechanism failure to optimize surface engineered microstructures.
3. Students will be able to identify appropriate testing approaches to evaluate service performance.
4. Students will be able to analyze real life surface failure problems and determine the correct surface engineering solution by applying contact mechanics.
5. Students will be able to analyze complex data and propose appropriate engineering solutions.

Content

UNIT-I **[05]**

Fundamentals of surface engineering Introduction: Engineering components, surface dependent properties and failures, importance and scope of surface engineering; Surface and surface energy: Structure and types of interfaces, surface energy and related equations; Surface engineering: classification, definition, scope and general principles.

UNIT-II **[08]**

Surface coatings and surface modifications Evaporation - Thermal / Electron beam Sputter deposition of thin films & coatings – DC & RF; Sputter deposition of thin films & coatings – Magnetron & Ion Beam; Hybrid / Modified PVD coating processes Chemical vapor deposition and PECVD; Plasma and ion beam assisted surface modification; Surface modification by Ion implantation and Ion beam mixing.

Characterization of coatings and surfaces Measurement of coatings thickness

porosity & adhesion of surface coatings; Measurement of residual stress & stability; Surface microscopy & topography by scanning probe microscopy; Spectroscopic analysis of modified surfaces

UNIT-III **[12]**

Conventional surface engineering Surface engineering by material removal

Cleaning, pickling, etching, grinding, polishing, buffing / puffing (techniques employed, its principle). Role and estimate of surface roughness; Surface engineering by material addition: From liquid bath - hot dipping (principle and its application with examples); Surface engineering by material addition: Electro-deposition / plating (theory and its scope of application);Surface modification of steel and ferrous components: Pack carburizing (principle and scope of application); Surface modification of ferrous and non ferrous components: Aluminizing, calorizing, diffusional coatings (principle and scope of application); Surface modification using liquid/molten bath: Cyaniding, liquid carburizing (diffusion from liquid state) (principle and scope of application); Surface modification using gaseous medium: Nitriding carbonitriding (diffusion from gaseous state) (principle and scope of application).

UNIT-IV **[15]**

Advanced surface engineering practices Surface engineering by energy beams

General classification, scope and principles, types and intensity/energy deposition profile; Surface engineering by energy beams: Laser assisted micro structural modification – surface melting, hardening, shocking and similar processes; Surface engineering by energy beams: Laser assisted compositional modification – surface alloying of steel and non-ferrous metals and alloys; Surface engineering by energy beams: Laser assisted compositional modification – surface

cladding, composite surfacing and similar techniques; Surface engineering by energy beams: Electron beam assisted modification and joining; Surface engineering by energy beams: Ion beam assisted microstructure and compositional modification; Surface engineering by spray techniques: Flame spray (principle and scope of application); Surface engineering by spray techniques: Plasma coating (principle and scope of application); Surface engineering by spray techniques: HVOF, cold spray (principle and scope of application); Characterization of surface microstructure and properties (name of the techniques and brief operating principle).

Functional Coatings & Applications Functional and nano-structured coatings and their applications in photovoltaic's, bio- and chemical sensors; Surface passivation of semiconductors & effect on electrical properties; Surface engineering of polymers and composites; Thin film technology for multi layers & superlattices for electronic, optical and magnetic devices; Modeling.

Reference Books

1. K.G. Budinski, Surface Engineering for Wear Resistances, Prentice Hall, Englewood Cliffs, 1988.
2. M. Ohring, The Materials Science of Thin Films, Academic Press Inc, 2005.
3. Peter Martin, " Introduction to Surface Engineering and Functionally Engineered Materials", John Willey
4. Mircea K. Bologa, " Surface Engineering and Applied Electrochemistry", Springer.
5. Devis, J.R.," Surface Engineering for Corrosion & Wear Resistance", 2001 Maney Publishing.

Subject: **Advanced Technical Communication and Soft Skills**								
Program: **B.Tech. All Branches**			Subject Code: **SH0607**			Semester: **VI**		
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	0	0	0	60	0	40	0	100

	Sr. No.	Content
Speaking	**1**	**Vocabulary Games: Advanced Level**
	2	**Role Play 1**
	3	**Role Play 2**
	4	**Role Play 3**
	5	**Selected speeches & Songs: Declamation 1**
	6	**Selected speeches & Songs: Declamation 1**
	7	**Report Presentation Seminar**
	8	**Report Presentation Seminar**
	9	**Report Presentation Seminar**
	10	**Interview Skills (Mock Interview Sessions 2)**

Writing	**11**	**Writing Reports**
	12	**Making Proposals**
	13	**Resume Building**
	14	**Letter, Email application**

Reference Books:

Fred Luthans, Organizational Behaviour, McGraw Hill

Lesikar and petit, Report writing for Business
M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill
Wallace and masters, Personal Development for Life and Work, Thomson Learning
Hartman Lemay, Presentation Success, Thomson Learning
Malcolm Goodale, Professional Presentations
Farhathullah, T. M. Communication skills for Technical Students
Michael Muckian, John Woods, The Business letters Handbook
Herta A. Murphy, Effective Business Communication
Lehman, Dufrene, Sinha BCOM, Cengage Learning

Web resources/ MOOCs:

Introduction to English Language & Literature Mod-1 Lec-1
https://www.youtube.com/watch?v=xC3M9EqduyI
The English Language Mod-1 Lec-
https://www.youtube.com/watch?v=HsR4jFszFdw#action=share
International English Mod-1 Lec-4
https://www.youtube.com/watch?v=FT4cQkXCc8g
Effortless EnglishRule-1 English Phrases:https://www.youtube.com/watch?v=r5z-lilm-gg

Pronunciation Training Techniques: https://www.youtube.com/watch?v=wB8mr4iViy0

Make Body Language Your Superpower:
https://www.youtube.com/watch?v=wB8mr4iViy0

English Job Interviews | Best Answers to Questions:
https://www.youtube.com/watch?v=wB8mr4iViy0

7TH SEMESTER

B TECH MECHANICAL ENGINEERING SEMESTER –VII TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	ME0701	Machine Design- II	04	02	00	05	06	30	10	60	00	00	100
2	ME0702	Power Plant Engineering	03	00	00	03	03	30	10	60	00	00	100
3	ME0703	Production Technology	04	00	02	05	06	30	10	60	40	60	200
4	ME0704	Computer Integrated Manufacturing	03	00	02	04	05	30	10	60	40	60	200
5	ME0705	Mechanical Vibrations	02	02	02	04	06	30	10	60	40	60	200
6	ME0706	Advanced Optimization Techniques (DE-III)	03	00	00	03	03	30	10	60	00	00	100
7	ME0707	Design Of Pressure Vessels And Piping (DE-III)											
8	ME0708	Robotics & Artificial Intelligence (DE-III)											
9	ME0709	Energy Conservation & Management (DE-III)											
10	ME0710	Advanced IC Engines (DE-III)											
11	ME0711	Advanced Refrigeration & Air Conditioning (DE-III)											
12	ME0712	Advanced Metrology & Computer Aided Inspection (DE-III)											
13	ME0713	Design For Manufacturing And Assembly (DE-III)											
14	ME0714	Advanced Metal Forming Processes (DE-III)											
15	ME0715	Manufacturing Process Technology I & II (DE-III) (MOOC)											
16	CV0712	Disaster Management	01	00	00	00	01	00	00	00	00	00	100
TOTAL			**20**	**04**	**06**	**24**	**30**	**180**	**60**	**360**	**120**	**180**	**1000**

Subject: Machine Design II								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0701**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	2	0	5	24/60	0	16/40	0	100

Course Objective

1. Develop an ability to apply knowledge of mathematics, science, and engineering
2. To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
3. To develop an ability to identify, formulate, and solve engineering problems.
4. To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes

1. Be able to analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts
2. Demonstrate knowledge on basic machine elements used in machine design; design machine elements to withstand the loads and deformations for a given application, while considering additional specifications.
3. Be able to approach a design problem successfully, taking decisions when there is not a unique
4. Be proficient in the use of software for analysis and design.

Content

UNIT-I **[14]**

Bearings

Lubrication, types, properties, selection, hydrostatic bearings, hydrodynamic lubrication-Reynold's equation, Journal bearing design principles.

Rolling contact bearing – selection, types, stribeck's equation, static & dynamic load rating, bearing life, selection of bearing from manual catalog, bearing designation, failure of rolling contact bearing.

UNIT-II **[16]**

Internal Combustion Engine Components

General design principles, design of principal parts – cylinder, cylinder head, piston, connecting rod, crank.

Material Handling System Design

Introduction, M.H. system design principles, factors for selection of M.H. equipments, design of crane hook, ropes and wires.

UNIT-III **[08]**

Spur And Helical Gears

Classification, materials, terminology, force analysis of spur gear, tooth failure, beam strength equation, design of spur gear, check for dynamic-static and wear loading condition, design of helical gear with checking for dynamic-static and wear loading condition.

UNIT-IV **[18]**

Bevel And Worm Gear

Terminology, formative no. of teeth, beam strength, design of worm gear, efficiency, force analysis of worm gear, heat removal analysis.

Design Of Gear Boxes

Geometric progression - Standard step ratio - Ray diagram, kinematics layout – Design of sliding mesh gear box -Constant mesh gear box, Design of multi speed gear box.

Text Books

1.Design of machine elements by V.B. Bhandari, Tata Mcgraw Hill Companies

2.Machine Design by Dr. S.S. Wadhwa, Dhanpat rai & Co.

3.Machine Design by P.C.Sharma& Aggarwal, Katariya& Sons.

Reference Books

1. Mechanical engineering design by Joseph shigley, Tata Mcgraw Hill Companies
2. Machine design by Robert L. Norton, Pearson education
3. Fundamentals of Machine component design by Juvinall&Marshek, Wiley India education

Web resources: www.nptel.ac.in

Subject: Power Plant Engineering								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0702**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
03	00	00	03	24/60	00	16/40	00	100

Course Objective

1. The course objective is to give fundamental knowledge of construction and working of various types of thermal power plants i.e. steam turbine, gas turbine, nuclear etc.

Course Outcome

1. Understand the different power generation methods, its economics and global energy situation
2. Apply the basic thermodynamics and fluid flow principles to different power generation methods
3. Analyze thermodynamic cycles of steam power plant and understand construction, working and significance of its various systems
4. Analyze thermodynamic cycles of gas turbine power plant, nuclear power plant and jet propulsion systems

Content

UNIT-I **[10]**

Thermal Power Plant

Introduction: Power and energy, classification of sources of energy, review of thermodynamic cycles related to power plants, General layout of modern thermal power plant, Site selection, and Present status of power generation in India.

Economics of Power Generation

Load curves, Load duration curves, Connected load, Maximum load, Peak load, base load and peak load power plants, Load factor, Plant capacity factor, Plant use factor, Demand factor, Diversity factor, Cost of power plant, Performance and operating characteristics of power plant, Tariff for electric energy

UNIT-II **[12]**

Diesel Power Plant

Essential components of diesel power plant, Different systems like fuel supply system, Engine cooling system, Engine lubrication system, Exhaust system, Engine starting and stopping system.

Nuclear Power Plant

Nuclear fusion and fission, Chain reaction, Nuclear fuels, Components of nuclear reactor, Classification of reactors, Pressurized water reactor, Boiling water reactor, Gas cooled reactor, CANDU reactor, Fast breeder reactor, Nuclear waste and its disposal, Nuclear power plants in India.

UNIT-III **[12]**

High Pressure Boilers & Accessories

Unique features and advantages of high pressure boilers, LaMont, Benson, Loeffler, Schmidt-Hartmann, Velox, supercritical, Supercharged and fluidized bed combustion boiler. Different types of super-heaters, Re-heaters, economizers, Air pre-heaters, Methods of superheat control, Corrosion in boilers and its prevention

Coal & Ash Handling Systems

Coal handling storage of coal, Burning systems, Types of stokers their working, Pulverized fuel handling systems, Unit and central systems, Pulverized mills- ball mill, Bowl mill, Ball &race mill, Impact or hammer mill, Pulverized coal burners, Oil burners. Necessity of ash disposal, Mechanical, Hydraulic, pneumatic and steam jet ash handling system, Dust collection and its disposal, Mechanical dust collector, Electrostatic precipitator.

UNIT-IV **[10]**

Condensers and Cooling Towers

Types of condensers, sources of air in condenser, Effects of air leakage, Methods of obtaining maximum vacuum in condenser, Dalton's law of partial pressure, vacuum & condenser efficiency, Mass of cooling water required, Air pump-Edward air pump. Necessity of cooling ponds and cooling towers, Condenser water cooling systems, Types of cooling towers, cooling ponds.

Draught System

Natural draught- estimation of height of chimney, Maximum discharge, Condition, Forced, Induced and balanced draught, Power requirement by fans.

Reference Books

1. Arora S.C and Domkundwar S, “A Course in Power Plant Engineering”, Dhanpat Rai, 2001
2. EI-Wakil M.M,Power “Plant Technology,” Tata McGraw-Hill 1984
3. K.K.Ramalingam,“Power Plant Engineering “, ScitechPublications,2002
4. G.R,Nagpal ,“PowerPlantEngineering”, KhannaPublishers1998
5. G.D.Rai,“IntroductiontoPowerPlanttechnology” KhannaPublishers,1995
6. F.T.Morse, Power Plant Engineering, Affiliated East-West Press Pvt. Ltd; New Delhi Madras.
7. P.K. Nag, Power Plant Engineering, Tata McGraw Hill.
8. R.Yadav, Steam & Gas Turbines & Power Plant Engineering, Central Publication House

Web Resources

https://www.youtube.com/watch?v=iWWyI8CZhUw

https://www.youtube.com/watch?v=IdPTuwKEfmA

https://www.youtube.com/watch?v=-LJkqydYbls&list=PLYuR1TUYRLpFrrm4CAElBP1-2XPB7QxD4

Subject: Production Technology								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0703**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	0	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. To understands the fundamental knowledge on various topics of Production technology subject.
2. To understands various aspects of designing Press working tools as per the Industry requirements.
3. To understands various aspects of designing Jigs and fixtures as per the Industry requirements.
4. To understands various methods of manufacturing Gears and Thread.
5. To understands various types of Automation and methods of controls for machine tools.

Course Outcomes

1. Ability to apply comprehensive knowledge in production engineering.
2. Ability to perform engineering analysis by designing and conducting appropriate experiments and analyzing problems of metal cutting.
3. Ability to design equipments and tooling for Pres working.
4. Ability to design equipments and tooling for Jigs and Fixtures..
5. Ability to design various aspects and methods for Gear and Thread manufacturing..

Content

UNIT-I **[06]**

Controls in Machine Tools

Machine tool drives, Machine tool structures, Machine tool spindles, Special purpose machines, Capstan and turret lathes, single spindle and multi spindle automats, bar type and chucking type

machines, Design of cam for single spindle automat Transfer Machines.

UNIT-II **[10]**

Gear and Threads Manufacturing

Different types of Threads Manufacturing methods and tools involved, Different gear forming and generating methods with their special features, Gears finishing processes.

UNIT-III **[15]**

Presses and Press Work

Classification of presses, Classification of dies, cutting actions in dies, clearance, cutting forces, center of pressure design of press tools, methods of mounting of punches, scrap reduction, strip layout.

UNIT-IV **[21]**

Theory of Metal Cutting

Principles of metal machining, cutting tools and tool materials, tool signature, mechanics of chip removal, cutting forces and parameters effecting it, cutting fluids, tool wear, tool life, economics of machining. Multi point cutting tools, temperature measurement at tool-work interface and its effects.

Jigs & Fixtures

Definition, its usefulness in mass production, design principles, locating systems and types of locators & clamps, jig bushes, design of jigs and fixtures for various machining operations

Text Books

1. Fundamentals of machining and machine tools, by Boothroyd -CRC publication
2. Metal Cutting principles, by M C Shaw, Oxford University press
3. Production Technology - H.M.T. By HMT

Reference Books

1. Tool Design by Donaldson, Tata McGraw Hill Pub.
2. Metal cutting Principles by Trent McGraw Hill Pub.
3. Workshop Technology Vol.II by Raghuvanshi , Dhanpat rai Pub.
4. Production Technology by R.K.Jain, Khanna Pub

5. Production Engineering & Science- by P.C.Pandey & C.K.Singh , Standard Pub.
6. A Text Book Of Production Engineering- by P.C.Sharma, S. Chand & Co. Ltd
7. Experimental Methods in Metal Cutting by Venkatesh .
8. Fundamentals Of Tool Design – American Society Of Tool Manufacturing
9. Manufacturing Science - by Amitabh Ghosh And Malik, Affiliated East West Pub.

List of Experiment

1. To study about Tool Materials.
2. To study about Tool Geometry.
3. To find influence of various process parameter on types of chips in metal cutting.
4. To find influence of various Cutting Fluids in machining process.
5. To perform experiment on Merchant's Force Circle Diagram.
6. To study of designing Press tool.
7. To study of Jig and Fixture.
8. To study about Gear and Thread manufacturing.
9. To study of designing of Single Point Cutting Tool.

Subject: Computer Integrated Manufacturing								
Program: B. Tech. Mechanical Engineering				Subject Code: ME0704			Semester: VII	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objective

1. Recognize the importance of CIM in today's technology and its impacts on market competition.
2. Automate tasks for preparing most appropriate manufacturing and assembly processes and their sequences.
3. Understand Robot Programming.
4. Analyze the engineering and economical aspects of AS/RS systems.

Course Outcome

1. Students will describe basic concepts of CAM application and understand CIM wheel
2. Students will prepare CNC programs for manufacturing of different geometries on milling and lathe machines.
3. Students will classify different components using different techniques of group technology.
4. Students will select layouts of FMS for industrial applications
5. Students will describe Robot for preliminary industrial applications like pick and place.
6. Student will identify application of PPC, JIT, MRP-I, MRP-II, and Expert system to CAM

Content

UNIT-I **[06]**

Introduction

Introduction to CIM Concepts & Scope of CIM, Nature & Type of Manufacturing System, Evolution, Benefits of CIM, Role of Manufacturing Engineers, CIM Wheel, CIM CASA wheel.

Group Technology

Introduction, Part Families, Part Classification and Coding, Machining Cells, Benefits of Group

Technology.

UNIT-II **[09]**

Flexible Manufacturing System

Introduction & Component of FMS, Needs of FMS, General FMS Consideration, Objectives, Types of FMS, Advantages of FMS, Manufacturing Cells, Cellular & Flexible Manufacturing, JIT & GT Applied to FMS & FMC, Tool Management, Tool Supply System, Tool Monitoring System, Work Piece Handling, Flexible Fixturing, Flexibility. FMS Scheduling, Sequencing, FMS Lay Out and Essentials

Material Handling and Storage

Types, Characteristics, Automated Material Movement & AS/RS AGVS, RGV Vehicles, Control and Application, Bar code Render, Walking Beam theory. Carousel Storage Systems, Engineering Analysis of AS/RS and Carousel Systems.

UNIT-III **[10]**

Robot Technology

Introduction, Industrial Robots, Robot physical Configuration, Basic Robot Motions, Robotic Power Sources, Sensors, Actuators, Transducer and Grippers. Programming of the Robot, Introduction to Robot Languages, Robot Applications & Economics.

Rapid prototyping

Introduction, Methods of Rapid Prototyping (subtraction, addition), Stereo lithography, Rapid tooling, FDM, 3-D Printing, LOM and SLS.

Computer Aided Production Management

Introduction, PPC fundamentals, Problems with traditional PPC, Use of Computer in PPC such as CAPP, MRPI, MRPII, CAGC etc.

UNIT-IV **[15]**

Numerical Control & Computer Numerical Control

Numerical Controls, Types, Evolution of Controllers, Components of NC/CNC System, Specification of CNC System. Classification of NC/CNC Machines, Transducers Used, Salient Features, Tape, Tape Codes and Tape Readers Used in NC Machines, Constructional Details of CNC Machines, Axis Designation, NC/CNC Tooling. Fundamentals of Manual Part Programming, Types of Format, Word Address Format, Manual Part Programming for Drilling, Lathe and Milling Machine Operations, Subroutines, Do Loops, Canned Cycles and Parametric

Sub Routines. Automated Programmed Tools Language- Its Types of Statement, Command and Programming

Text Books

1. Computer Aided Manufacturing by Tien Chien Chang, Pearson Education
2. Automation, Production Systems and Computer Integrated Manufacturing by Groover, Pearson Education

Reference Books

1. CNC programming – Dr. S. K. Sinha – Galgotia publications.
2. Flexible Manufacturing Cells and System -William. W. Luggen Prentice Hall, England Cliffs, New Jersey
3. P.Radhakrishnan, "Computer Numerical Control ", New Central Book Agency, 1992.
4. Computer integrated manufacturing -S. Kant Vajpayee – Prentice Hall of India.
5. Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill, 1993
6. CAD/CAM, Principles and Applications –P N Rao, McGraw Hill, 2010
7. CAD/CAM, Introduction, -Ibrahim Zeid, Tata McGraw Hill, 2007
8. CAD/CAM, Groovers and Zimmers, Pearson

Web Resources: www.nptel.ac.in

List of Experiments:

1) To study about Group Technology.
2) To Study about Flexible Manufacturing System.
3) To Study about Robot Technology.
4) To Study about Computer aided Production and Operation Management.
5) To study about Numerical Control in Machine Tool.
6) Manual Part Programming for Turning.
7) Manual Part Programming for Milling.
8) Manual Part Programming for Drilling.
9) Manual part programming for Parametric Subroutine.
10) APT programming for Turning, Drilling and Milling.

Subject: Mechanical Vibrations								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0705**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
2	2	2	4	24/60	24/60	16/40	16/40	200

Course Objectives and Outcomes

1. To study basics of vibration.
2. To study of single degree of freedom systems- forced undamped and damped vibrations.
3. To study of Two degree of freedom systems.
4. To study Multi-Degree of freedom systems and Natural Frequency calculations.
5. To study about continuous system.

Content

UNIT-I **[10]**

Introduction

Vibration terminology, Harmonic and periodic motions, Beats phenomenon, uses and effects, practical applications and current research trends

Single Degree of Freedom Systems – Free Undamped and Damped Vibrations

Free undamped vibrations using Newton's second law, D'Alemberts principles, Energy method, Rayleigh's method, free damped vibrations, logarithmic decrement, under damped, over damped and critically damped conditions**.**

UNIT-II **[12]**

Single Degree of Freedom Systems –Forced Undamped and Damped Vibrations

Forced harmonic undamped vibration, Damped free Magnification factor, Transmissibility, Vibration Isolation, Equivalent viscous damping, Rotor unbalance, Excitation and Stability analysis

Two Degree of Freedom Systems

Generalized and Principal coordinates, derivation of equations of motion, Lagrange's equation, Coordinate coupling, Forced Harmonic vibration.

UNIT-III **[14]**

Multi-Degree of Freedom Systems

Derivation of equations of motion for MDOFs, influence coefficient method, Properties of undamped and damped vibrating systems: flexibility and stiffness matrices, reciprocity theorem, Modal analysis.

Natural Frequency Calculations

Rayleigh method, Stodala method, Matrix iteration method , Holzer's method and Dunkerley's method, Whirling Speed of shaft.

UNIT-IV **[14]**

Continuous Systems

Introduction to continuous systems, lateral vibration of string, transverse vibrations of the beam, Orthogonality of eigenvectors.

Vibration Measurement Apparatus

Vibration measuring instruments, acceleration and frequency measuring instruments, FFT analyzer**.**

Reference Books

1. Mechanical Vibration by Singiresu S. Rao, Pearson Education
2. Mechanical Vibrations by G.K. Groover, Nemchand & Bro
3. Theory of Vibration with Application by Willium T Thomson, Pearson Education
4. Theory and Problems of Mechanical Vibrations by Graham Kelly, schaum series
5. Fundamental of Mechanical Vibrations by Graham Kelly Mcgraw hill

Web resources: www.nptel.ac.in

List of Experiments

1. To study frequency of simple pendulum.
2. To study frequency of compound pendulum.
3. To study frequency of sprig mass system.
4. To study frequency of lateral vibration system.
5. To study frequency of torsion vibration system (single Rotor).

6. To study free damped vibration system.
7. To study whirling speed of shaft.
8. To study forced damped vibration system.
9. To study frequency of simple pendulum with considering mass of rod
10. To study frequency of roller rolls without slip inside cylinder.
11. To study frequency of U tube filled with liquid.

Subject: Advanced Optimization Techniques (DE-II)								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0706**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	00	16/40	00	100

Course Objective

1. To introduce the Advance concepts of Optimization Techniques;
2. To make the learners aware of the importance of optimizations in real scenarios;
3. To provide the concepts of various classical and modern methods of for constrained and unconstrained problems in both single and multivariable.

Course Outcomes

1. Upon successful completion of this course, students will be able to formulate optimization problems;
2. Understand and apply the concept of optimality criteria for various type of optimization problems;
3. Solve various constrained and unconstrained problems in single variable as well as multivariable;
4. Apply the methods of optimization in real life situation

Content

UNIT-I **[12]**

Introduction to Optimization

Introduction, Historical Development, Engineering Applications of Optimization, Statement of an Optimization Problem, Classification of Optimization Problems, Engineering Optimization Literature, Solution of Optimization Problems Using MATLAB

Classical Optimization Techniques

Introduction, Single-Variable Optimization, Multivariable Optimization with No Constraints,

Multivariable Optimization with Equality Constraints, Multivariable Optimization with Inequality Constraints, Convex Programming Problem.

UNIT-II **[08]**

Nonlinear Programming

Uni-modal Function Elimination methods, Unrestricted Search Exhaustive Search, Dichotomous Search Interval Halving Method, Fibonacci Method, Golden Section Method Comparison of Elimination Methods, Interpolation methods Quadratic Interpolation Method, Cubic Interpolation Method, Direct Root Methods

Practical Considerations

UNIT-III **[16]**

Modern Methods of Optimization

Genetic Algorithms, Numerical Results, Simulated Annealing, Features of the Method, Numerical Results, Particle Swarm Optimization, Computational Implementation of PSO, Pheromone Trail Evaporation, Optimization of Fuzzy Systems, Fuzzy Set Theory, Optimization of Fuzzy Systems, Computational Procedure, Numerical Results, Neural-Network-Based Optimization .

UNIT-IV **[12]**

Geometric and Dynamic Programming

Constrained Minimization , Solution of a Constrained Geometric Programming Problem ,Primal and Dual Programs in the Case of Less-Than Inequalities ,Geometric Programming with Mixed Inequality Constraints ,Complementary Geometric Programming ,Applications of Geometric Programming ,Multistage Decision Processes ,Representation of a multistage Decision Process ,Conversion of a Nonsocial System to a Serial System ,Concept of Sub optimization and Principle of Optimality ,Computational Procedure in Dynamic Programming

Textbooks

1. Optimization Techniques- Singiresu S. Rao, John Wiley & Sons, Inc., Hoboken, New Jersey

Reference Books

1. Operation research – P. Rama Murthy, New Age, New Delhi.
2. An Introduction to Optimization- E. Chong,
3. S. Zak, wiley-interscience series in discrete mathematics and optimization

Subject: Design of Pressure Vessels And Piping (DE-II)								
Program: B.Tech. Mechanical Engineering				Subject Code: ME0707			Semester: VII	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
03	00	00	03	24/60	00	16/40	00	100

Course Objectives

1. The main objective is to present the industrial related problems, procedures and design principles for pressure vessels and enhance the understanding of design procedure of pressure vessel and Design of piping layout.

Course Outcomes

1. It helps the student to get familiarized with the various theories and practice on pressure vessel and piping design and procedures which are necessary to solve the industrial practical problems that arise and also for the research in the field of pressure vessel design.

Content

UNIT-I **[09]**

Introduction

Introduction to pressure vessels, classification, material selection, loads & types of failures – stresses in pressure vessels, types of shells, dished ends, nozzles, flanges and support structure. Introduction to ASME code.

UNIT-II **[11]**

Piping

Introduction – Flow diagram – piping layout and piping stress Analysis.

UNIT-III **[11]**

Design of Pressure Vessels

Design of shell, Dished End, Flanges based on Internal Pressure and External Pressure as per ASME code, Reinforcement of the Nozzles, Stress analysis of different components of vessel based on wind and seismic loads as per IS/UBC/NBC codes.

UNIT-IV **[10]**

Design of Support Structure

Design of base Ring, Compression Ring, Skirt, Support lugs for vertical & horizontal vessels. Evaluation of vessels for various conditions like hydro tests.

Text Books

1. John F. Harvey, Theory and Design of Pressure Vessels, CBS Publishers and Distributors, 1987.

Reference Books

1. "ASME Pressure Vessel and Boiler code, Section VIII Div. 1, 2, and 3", ASME.
2. "American standard code for pressure piping, B 31.1", ASME.
3. Henry H Bednar, "Pressure vessel Design Hand book", CBS publishers and distributor.
4. William. J., Bees, "Approximate Methods in the Design and Analysis of Pressure Vessels and Piping", Pre ASME Pressure Vessels and Piping Conference, 1997.
5. Stanley, M. Wales, "Chemical process equipment, selection and Design. Butterworth's series in Chemical Engineering, 1988.
6. Smith P, Fundamentals of Piping Design, Elsevier
7. Handbook of piping Design
8. Brownell L. E and Young. E. D, "Process equipment design", Wiley Eastern Ltd., India

Subject: Robotics & Artificial Intelligence (DE-II)								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0708**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objective

1. To be familiar with the automation and br ief history of robot and applications.
2. To give the student familiarities with the kinematics of robots.
3. To give knowledge about robot end effectors and their design.
4. To learn about Robot Programming methods & Languages of robot.
5. To give knowledge about various Sensor s and their applications in robots.

Course Outcomes

1. Students will be equipped with the automation and brief history of robot and applications.
2. Students will be familiarized with the kinematic motions of robot.
3. Students will have good knowledge about robot end effectors and their design concepts.
4. Students will be equipped with the Programming methods & various Languages of robots.
5. Students will be equipped with the principles of various Sensors and their applications in robots.

Content

UNIT-I **[08]**

Introduction

Laws of robot, progressive advancement of robots, robot anatomy, Arm configuration, Wrist configuration, End effectors, Human arm characteristics.

Coordinate Frames Mapping & Transformations

Coordinate frames, Mapping, Description of objects in space, Transformation of vectors, Inverting a homogeneous transform, Principal axis rotation. Fixed angle representation, Eular

angle representation, and Equivalent angle representation.

UNIT-II **[08]**

Introduction to Artificial Intelligence (AI)

The AI problems, the underlying assumption, what is an AI technique? The level of the model, criteria for success, Defining the problem as a state space search, production systems, problem characteristics, production system characteristics, issues in the design of search problems. Heuristic search techniques: Generate and test, hill climbing, best first search, problem reduction, constraint satisfaction, Means – Ends analysis.

UNIT-III **[12]**

Direct Kinematic Model

Description of links and joints, Kinematic modeling of the manipulator, Denavit – Hartenberg notation, Link frame Assignment. Kinematic relationship between adjacent links, Manipulator transformation matrix.

Inverse Kinematics

Manipulator work space, Solvability of inverse kinematic model, Existence of solutions, multiple solutions Solution techniques, closed form solution.

UNIT-IV **[08]**

Artificial Neural Networks, Fuzzy Logic & Genetic Algorithm

Introduction, historical note, biological and artificial neurons, multilayer perception, modeling the problem, types of data involved, training, issues in ANN, applications of ANN in robotics, Introduction to fuzzy sets, classical sets, properties of classical sets and their operations, properties of fuzzy sets and their operations, classical vs fuzzy relations, introduction to fuzzy logic, fuzzy control and its applications in robotics, Introduction to GA, genetic search, genetic programming, applications in robotics.

Reference Books

1. Robotics and control, by R K Mittal & I J Nagrath, Mc- Graw Hill Education.
2. John. J. Craig, “Introduction to Robotics: Mechanics and Control”, Pearson education
3. E. Rich, K. Knight and S. B. Nair, “Artificial Intelligence”, Tata McGraw-Hill publication

4. Amit Konar, “Artificial Intelligence and Soft Computing: Behavioral and Cognitive modeling of the human brain”, CRC Press
5. A. Zilouchian and M. Jamshidi, “Intelligent control systems using soft computing methodologies”, CRC Press
6. Robot dynamics & control by M W Spong & M. Vidhyasagar, John Wiley & Sons New York.
7. Automation and Robotics by Juan Manuel Ramos Arreguin, InTech 2008.
8. Modelling identification & control of robots by W Khalil & E Dombre , Kogan page science paper edition.

Web resources: www.nptel.ac.in

Subject: Energy Conservation and Management (DE-II)								
Program: B.Tech. Mechanical Engineering				Subject Code: ME0709			Semester: VII	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
03	00	00	03	24/60	00	16/40	00	100

Course Objectives

1. How to conserve energy
2. How to do effective management of energy
3. To learn financial management of energy
4. To carry out energy audit for commercial and industry purpose
5. Study to improve energy efficiency of various devices of mechanical industries
6. To study environment impact due to energy conservation

Course Outcomes

1. Student will come to know the present energy scenario
2. Energy management, conservation and financial aspect will be understood by students
3. Able to carry out energy audit effectively
4. Will learn improvement of energy efficiency of various mechanical machines
5. Recent environment effects and climate change effects will be understood by all

Content

UNIT-I **[08]**

Energy Scenario

Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future. Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy.

Financial Management

Investment-need, appraisal and criteria, financial analysis techniques, simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs).

[08]

UNIT-II

Energy Monitoring and Targeting

Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM). Energy Management Information Systems (EMIS).

Energy Audit

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering.

[10]

UNIT-III

Energy Efficiency in Thermal Devices-I

Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation,

Furnaces: Classification, general fuel economy measures in furnaces, excess air, heat distribution, temperature control, draft control, waste heat recovery. Forging furnace heat balance, Cupola, non-ferrous melting, Induction furnace, performance evaluation of a furnace.

Energy Efficiency in Thermal Devices-II

Insulation and Refractoriness: Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractory, heat loss.

Waste Heat Recovery: Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential.

UNIT-IV **[08]**

Energy Efficiency in Thermal Devices-III:

Heating, Ventilation, Air Conditioning (HVAC) and Refrigeration System

Factors affecting Refrigeration and Air conditioning system performance and energy savings opportunities. Vapor absorption refrigeration system comparison with vapor compression system and saving potential, heat pumps and their applications, performance assessment of window and split room air conditioners.

Energy, Environment and Climate Change

United Nations Framework Convention on Climate Change (UNFCC), Sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures case of CDM, Prototype Carbon Fund (PCF). Carbon Credit Concept,

National action plan on climate change, ECBC code for Building Construction.

Text Books

1. Bureau of Energy Efficiency Reference book: No.1, 2
2. Bureau of Energy Efficiency Reference book: No. 3, 4
3. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Inter science publication

Reference Books

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
3. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing
4. Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994

Web Resources

1. https://www.youtube.com/watch?v=iWWyI8CZhUw
2. https://www.youtube.com/watch?v=IdPTuwKEfmA

3. https://www.youtube.com/watch?v=-LJkqydYbls&list=PLYuR1TUYRLpFrrm4CAElBP1-2XPB7QxD4
4. www.nptel. Iitm.ac.in
5. www.bee.com
6. www.powermin.nic.in
7. www.teriin.org
8. https://geda.gujarat.gov.in

Subject: Advance Internal Combustion Engine (DE-II)								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0710**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
03	00	00	03	24/60	00	16/40	00	100

Course Objectives

1. To understand the fundamental principles of operation of different IC Engines and components.
2. To provide knowledge on pollutant formation, control, alternate fuel etc.
3. To make the students familiar with the recent IC engine techniques such as HCCI, CRDI, GDI, etc. with latest measuring equipments.

Course Outcomes

1. Do in-depth cycle analysis for different types of engines.
2. Analyze fuel supply systems, ignition and governing systems of IC Engines.
3. Understand combustion process of SI and CI Engines.
4. Measure operating characteristics of IC Engines.
5. Compare the experimental results with theoretical trends

Content

UNIT-I **[09]**

Engine Operating Parameters

Engine operating cycles, spark ignition engine operation, compression, brake torque and power, mechanical efficiency, mean effective pressure, specific fuel consumption, air/fuel and fuel/air ratio, specific emission and emission index, engine design and performance data

Reactive Systems

Stoichiometric equation for fuel air reaction, equivalence ratio, enthalpy of formation, first law analysis for steady state reacting system, enthalpy of combustion, internal energy of combustion and heating values, adiabatic combustion temperature, dissociation.

UNIT-II **[09]**

Gas Exchange Processes

Flow through valves, phase of the flow, scavenging in two stroke cycle engines, turbulence, swirl, squish, flow in intake manifolds, analysis of suction and exhaust processes, fuel injection systems.

Non Conventional IC Engine

Introduction, Dual fuel and multi fuel engines, stratified charge engine, adiabatic engines, Variable compression ration engines, Free piston engines, stirling engines, wankel rotary engines

UNIT-III **[10]**

Emission Control in IC Engine

Formation of nitrogen oxides, carbon monoxide, hydrocarbon emission in petrol and diesel engines, SI and CI engine particulates, soot formation and control, exhaust gas temperature, catalytic convertor.

Alternate Fuels

Fuels and their properties : hydrogen, bio gas, alcohols, producer gas, LPG, CNG, non edible vegetable oils, NH3 as substitute fuel for SI and CI engine, fuel additives.

UNIT-IV **[11]**

Testing of IC Engines

Measurement of friction power, indicated power, brake power, fuel consumption, air consumption, emission. Heat balance sheet

Recent Developments in IC Engines

PIV in turbulence measurement, optical methods for flame velocity measurement, new materials for engine components, improved two stroke engines, hybrid engines and vehicles, lean burn engines, stratified charge engines, HCCI engines

Text Books

1. Internal combustion engines by Mathura & Sharma, Dhanpat rai & Sons, New Delhi.
2. Internal Combustion Engine by V Ganeshan, McGraw Hill Education Pvt Ltd.
3. A course in internal combustion engines by V.M.Domkundwar, Dhanpat rai &Co.(p) ltd,

New Delhi

4. Internal Combustion Engine Fundamentals by John B. Heywood, McGraw Hill Education Pvt Ltd.

Reference Books

1. Internal Combustion Engines: Applied Thermo-sciences, Colin R Ferguson, John Wiley and Sons
2. Internal combustion engines by Ramalingam (Scitechpub. India Pvt. Ltd., Chennai).
3. Internal combustion engines by H. N. Gupta, PHILearning, NewDelhi.

Web Resources

1. www.nptel.com
2. www.howstuffworks.com

Subject: Advanced Refrigeration & Air Conditioning (DE-II)								
Program: B.Tech. Mechanical Engineering				**Subject Code: ME0711**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
03	00	00	03	24/60	00	16/40	00	100

Course Objectives

1. To understand recent trends in Refrigeration & Air Conditioning Industry.
2. Problem oriented in depth knowledge of Advanced Refrigerator & Air Conditioning Systems.

Course Outcome

1. To indicate refrigeration processes on P-h & T-S Diagrams.
2. Estimation of Heating & Cooling Loads for various practical applications.
3. Cryogenic cooling techniques

Content

UNIT-I **[08]**

Vapour Compression System

Simple VCR system on P-V, T-S, P-h diagram, factors affecting the performance of the system, actual cycle considering different losses. Need, flash tank, analysis of two evaporators with flash inter cooler and individual and multiple expansion valve, estimation of power requirement and COP.Analysis of the compound vapour compression refrigeration system with use of p-H charts and solution of problems. Balancing of vapor compression refrigeration system components. Dual pressure vapor compression refrigeration system and its analysis.

UNIT-II **[09]**

Vapour Absorption Refrigeration System

Theory and working fundamental of VARS; comparison of VARS against VCRS; advantages of VARS refrigeration system. Basic VARS system and functioning of different components; meaning of use of two fluids. Types of VARS system. Analysis of water ammonia absorption system based on enthalpy concentration charts and equilibrium charts; heat balance and C.O.P. Two stage vapor absorption refrigeration system.

Non-Conventional Refrigeration System (Principle and Thermodynamic Analysis Only)

Thermoelectric refrigeration, Thermo-acoustic refrigeration, adsorption refrigeration,Steam jet refrigeration, vortex tube refrigeration, and magnetic refrigeration, Cryogenic Refrigeration.

UNIT-III **[09]**

Psychrometry – Psychrometric Processes

Determination of condition of air entering conditioned space. Air conditioning systems – summer, winter and year-round-year air conditioning systems -- central and unitary systems. Requirement of air conditioning – human comfort – comfort chart and limitations – effective temperature – factors governing effective temperature – design considerations.

Air-Conditioning Systems

Classification, system components, all air, all water, air water systems, room air conditioners, packaged air conditioning plant, central air conditioning systems, split air conditioning systems. Application & Safety in various industries like food, Pharmacy, Electronic,Paper,Paint,Metallurgy,Foundry,Hospitals,Hotel & Reception, Automobile,Rail-Road & Aircraft

Heating Systems

Heating systems – warm air systems – hot water systems – steam heating systems panel and central heating systems, Heat pump circuit, Heat sources for heat pump.

UNIT-IV **[09]**

Air Conditioning Equipment and Control System

Air filters – humidifiers – fan – blowers control systems for temperature and humidity– noise control. Installation and charging of refrigeration unit, Testing for leakage, Cause for faults and

rectification.

Cooling Load Estimation Equipment Selection and Design

Component Balancing, Analysis of designed equipment (thermodynamic), cost analysis and feasibility analysis for designed equipment, tools and equipment used in refrigeration. solar heat gain, study of various sources of the internal and external heat gains, heat losses, etc. Methods of heat load calculations: Equivalent Temperature Difference Method, Cooling Load Temperature Difference and Radiance Method Inside and outside design conditions,

Design of Air Conditioning Systems

Duct design – equal friction method -- static regain method -- velocity reduction method, Air distribution systems, terms in air distribution, grills, use of friction chart equivalent diameter, dynamic losses and its determination, outlets, application, location.R

Reference Books

1. Desai P.S, Modern Refrigeration and Air-conditioning Khanna Publishers, 2004
2. Hainer R. W., Control System for Heating, Ventilation and Air conditioning, Van
3. Nastrand Reinhold Co., New York, 1984.
4. Arora. C.P., Refrigeration and Air Conditioning, Tata McGraw-Hill New Delhi, 1988
5. S C Arora & S Domkundwar, 'Refrigeration and Air-Conditioning' Dhanpat Rai Publication,
6. Ahmadul Ameen "Refrigeration and Air Conditioning", Prentice Hall of India Pvt. Ltd. 2010
7. Ramesh Arora ," Refrigeration and Air-conditioning", Prentice Hall of India, 2010
8. R.K.Rajput "Refrigeration and air conditioning"; S. K. Kataria & Sons; Delhi
9. Ballaney P.L; "Refrigeration and air conditioning"; Khanna Book Publishing Co.(P) Ltd. Delhi.

Web Resources

1. http://nptel.ac.in/courses/112105128
2. https://swayam.gov.in/search?keyword=Refrigeration%20and%20air-conditioningcontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/New_index1.html
3. http://www.newagepublishers.com/samplechapter/001246.pdf

Subject: Advance Metrology and Computer Aided Inspection (DE-II)								
Program: B. Tech. Mechanical Engineering				Subject Code: ME0712			Semester: VII	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries.
2. To make the students capable of learning to operate and use advanced metrological devices with ease in industrial environments.

Course Outcome

1. Understand the advanced measurement principles with ease.
2. Operate sophisticated measurement and inspection facilities
3. Design and develop new measuring methods

Content

UNIT-I **[04]**

Basic Concepts of Measurement

Terms used in measurement, Classification of measurements, Classification of measurement errors, Measuring instruments and their properties, Length measurement, Angle measurements, Direct and indirect methods, Instruments used, Design of limit gauges, Geometric tolerances – key aspects, symbols, tolerance frame, datum symbols, tolerance feature and interpreting drawing.

UNIT-II **[06]**

Uncertainty analysis:

Measurement and error, Type A and Type B categories of uncertainty, Combined type A and type B, Evaluation of uncertainty

UNIT-III **[12]**

Form metrology:

Measurement of roughness, waviness, flatness, roundness, cylindricity, radius, screw, gear, Methods of improving accuracy & surface finish, Influence of forced vibration on accuracy, Dimensional wear of cutting tools and its influences on accuracy.

Miscellaneous Measurements

Measurement of Force, Torque, Speed, Displacements etc

UNIT-IV **[18]**

Computer Aided Metrology:

Coordinate measurement machine (CMM), Applications, Advantages, Type of CMM & applications, Constructional features of CMM, Probes – Touch trigger probe and non contact trigger probers, operation and programming, Examination of surface texture, possible sources of error in CMM, Image Analysis and Computer Vision.

LASER Metrology:

Types of laser, Laser in engineering metrology, methods of laser metrology, Laser interferometer, Laser alignment telescope, Laser micrometer, On-line and in-process measurements of small diameter, large displacement, Roundness and surface roughness using LASER, Micro profile and topography measurements, Testing of machine tools.

References:

1. Gupta, I.C., “A Text Book of engineering metrology”, Dhanpat Rai and Sons, 1996.
2. Jain ,R.K.,“Engineering Metrology”, Khanna Publishers, 2008.
3. Bewoor, A.K. and Kulkarni,V.A.,”Metrology and Measurement”, Tata Mc Graw-Hill, 2009.
4. Galyer, F.W. and Shotbolt, C.R., “Metrology for engineers”, ELBS, 1990.
5. Smith,G.T., “Industrial Metrology”, Springer, 2002
6. Whitehouse,D.J., "Surface and their measurement", Hermes Penton Ltd, 2004.
7. “ASTE Handbook of Industries Metrology”, Prentice Hall of India Ltd., 1992.
8. Rajput,R.K., “Engineering Metrology and Instrumentations”, Kataria & Sons Publishers, 2001.

9. Sonka,M., Hlavac,V. and Boyle.R., “Image Processing, Analysis, and Machine Vision”, Cengage-Engineering, 2007.

Web References:

1. www.metrologytooling.com
2. www.iuk’tu-harburg.d

Subject: Design for Manufacturing, Assembly and Environment (DE-II)								
Program: B. Tech. Mechanical Engineering				Subject Code: ME0713			Semester: VII	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To introduce the concept and application for design for manufacturing and assembly to Practicing designers and manufacturing engineers as well as design students
2. To discuss various fundamentals of assembly and design recommendations for product Development

Course Outcome

1. Outline the appropriate design for economical production and select the materials.
2. Select between various machining and metal joining processes.
3. Apply a systematic understanding of knowledge in the field of metal casting and forging.
4. Fabricate basic parts and assemblies using powered and non – powered machine shop equipment in conjunction with mechanical documentation

Content

UNIT-I **[06]**

Introduction

General design principles for manufacturability, Strength and mechanical factors, mechanisms selection, Evaluation method, Process capability, Feature tolerances, Geometric tolerances , Assembly limits –Datum features, Tolerance stacks

UNIT-II **[09]**

Factors Influencing Form Design

Working principle, Material, Manufacture, Design, Possible solutions, Materials choice, Influence of materials on form design, Form design of welded members, Forgings and castings.

UNIT-III **[11]**

Component Design – Machining Consideration

Design features to facilitate machining , Drills, Milling cutters, keyways, Doweling procedures, Counter sunk screws, Reduction of machined area , Simplification by separation, Simplification by amalgamation, Design for machinability, Design for economy, Design for clampability, Design for accessibility, Design for assembly.

UNIT-IV **[14]**

Component Design – Casting Consideration

Redesign of castings based on parting line considerations, minimizing core requirements, machined holes, Redesign of cast members to obviate cores. Identification of uneconomical design, Modifying the design, Group technology, Computer Applications for DFMA.

Design for Environment

Introduction, Environmental objectives, Global issues, Regional and local issues, Basic DFE methods, Design guide lines, Applications, Lifecycle assessment: Basic method, AT&T's environmentally responsible product assessment , Weighted sum assessment method, Lifecycle assessment method, Techniques to reduce environmental impact , Design to minimize material usage, Design for disassembly: Design for recyclability, Design for remanufacture, Design for energy efficiency, Design to regulations and standards.

Text Books:

1. James G. Bralla, Design for Manufacturability Handbook, 2nd Edition, McGraw hill, 1999.
2. Joseph Fiksel, Design for Environment, 2 nd Edition, McGraw hill, 2012. References: 1. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994. 2.

Dixon, R. John and Corroda Poli, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995.

3. Kevien Otto and Kristin Wood, Product Design, Pearson Publication, 2004.

Subject: Advanced Metal Forming Processes (DE-II)								
Program: B. Tech. Mechanical Engineering				Subject Code: ME0714			Semester: VII	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. This chapter aims to provide additional information on several techniques of metal forming processes other than those conventional process already mentioned in previous chapters.
2. The requirements for the process selection will be added, which are based on advantages and disadvantages of each type of non-conventional metal forming processes.

Course Outcomes

1. Students will learn the basics of plasticity
2. Students will understand the fundamentals of metal working
3. Students will attain proficiency in basic meta l forming techniques, forging, extrusion, drawing and rolling.

Content

UNIT-I **[06]**

Introduction to Theory of Plasticity and Forming

Theory of plastic deformation – yield criteria – tresca and von – mises – distortion energy – stress – strain relation – mohr's circle reperesentation of a state of stress – cylindrical and spherical co – ordinator system – upeer and lower bound solution methods – thermo elastic elasto – plasticity – eleasto – visco plasticity

UNIT-II **[09]**

Bulk Forming Processes

Analysis of plastic deformation in forging, rolling, extrusion, rod/wire drawing and tube drawing – effect of friction – calculation of forces, work done – process parameters, equipment used, defects, applications, recent advances in forging, rolling, extrusion and drawing processes – 19 design consideration in forming – formability of laminated sheet – overview of FEM applications in metal forming analysis.

UNIT-III **[11]**

Advance Sheet Metal Forming

Formability studies – convectional processes – H E R F techniques – super plastic forming techniques – hydro forming – stretch forming – water hammer forming – principles and process parameters – advantages, limitation and application, die less or incremental forming, micro forming

UNIT-IV **[14]**

Powder Metallurgy and Special Forming Processes

Overview of P/M technique – advantages – applications – powder perform forging – powder rolling – tooling, process parameters and applications. – orbit forging – isothermal forging – hot and cold iso – static pressing – high speed extrusion – rubber pad forming – fine blanking – LASER beam forming

Electromagnetic forming and its application

Electromagnetic forming process – electro – magnetic forming machine – process variables – cols and dies – effect of resistivity and geometry – EM tube and sheet forming, stamping, shearing and welding – applications – finite element analysis of EM forming

Text Books

1. Dieter G.E, Mechanical Metallurgy (revised edition II) McGraw Hill Co., 2004
2. Mechanics of Metal Forming, Z. Marciniak, J.L .Duncan, S.J.Hu, Butterworth Heinemann an Imprint of Elsevier,2006

3. Metal Forming – Mechanics & Metallurgy, William F. Hosford, Robart M. Caddell, Cambridge University press, Third Edition.

References Books

1. Proceedings of international workshop on EMFT 2010, Anna University.
2. Altan T., Metal forming – fundamentals and application – American society of metals, metals park, 2003.
3. ASM hand book, Forming and Forging, Ninth edition.

Subject: **Disaster Management**								
Program: **B.Tech. Civil Engineering**				Subject Code:CV0712			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	-	0	0	24/60	0	16/40	0	100

Course Objectives:

1. To explain students the conceptual applications and principles of management to mitigate various disasters.

Course Outcome:

1. Understand disasters, disaster preparedness and mitigation measures.
2. Understand role of IT, remote sensing, GIS in risk reduction.
3. Understand disaster management acts and guidelines along with the role of various stack-holders during disasters.

COURSE CONTENTS:

UNIT-I **[03]**

Introduction

Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention,mitigation)

UNIT-II **[04]**

Disasters classification

Natural disasters (floods, drought, cyclones, volcanoes, earthquakes,tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrialpollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard andvulnerability profile of India, mountain and coastal areas, ecological fragility

UNIT-III **[06]**

Disaster Impacts

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health,psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; globaland national disaster trends; climate-change and urban disasters. Disaster Risk Reduction

Disaster management cycle

Phases; prevention, mitigation, preparedness, relief andrecovery; structural and non-structural measures; risk analysis, vulnerability and capacityassessment; early warning systems, Post-disaster environmental response (water, sanitation,food safety, waste management, disease control); Roles and responsibilities ofgovernment,community, local institutions, NGOs and otherstakeholders; Policies and legislation for disasterrisk reduction, DRR programmes in India and the activities of National DisasterManagementAuthority.

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UNIT-IV **[02]**

Applications of Science and Technology for Disaster Management and Mitigation

Geo-informatics in Disaster Management (RS, GIS and GPS), Disaster Communication System (Early Warning and Its Dissemination), Land use planning and development regulations, Disaster safe designs and Development Regulations, Disaster safe designs and Construction structural and Non structural Mitigation of Disasters. Science and Technology Institutions for Disaster Management in India.

Text Books:

1. Ghosh G.K., 2006, Disaster management, APH Publishing Corporation.

Reference Books:

2. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
3. Singh B. K., 2008, Handbook of Disaster Management: techniques and guidelines, Rajat Publications

Web resources:

1. http://nidm.gov.in/PDF/Disaster_about.pdf

2. https://www.slideshare.net/Jyothi19587/disaster-ppt
3. https://www.slideshare.net/SayefAmin1/natural-disaster-its-causes-effects
4. https://www.slideshare.net/rahulp4/man-made-disasters-23947076
5. https://www.slideshare.net/urveshprajapati3990/disaster-management-in-india-56546805
6. www.ndmindia.nic.in/presentation/Presentation%20by%20JS%20(DM)%20(1).ppt
7. https://www.geospatialworld.net/article/information-technology-and-natural-disaster-management-in-india/
8. http://www.bvicam.ac.in/news/NRSC%202007/pdfs/papers/st_230_03_02_07.pdf
9. http://eagri.tnau.ac.in/eagri50/ENVS302/pdf/lec13.pdf
10. http://nptel.ac.in/courses/105105104/pdf/m16l39.pdf
11. https://www.unisdr.org/we/inform/events/50220

MOOCs:

1. https://www.mooc-list.com/tags/disaster-management

8TH SEMESTER

B TECH MECHANICAL ENGINEERING SEMESTER –VIII TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017														
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME						
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	ME0801	Project	00	00	40	20	40	00	00	00	40	60	100
TOTAL			**00**	**00**	**40**	**20**	**40**	**00**	**00**	**00**	**40**	**60**	**100**

Subject: Project								
Program: B. Tech. Mechanical Engineering				**Subject Code: ME0801**			**Semester: VIII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
00	00	40	20	00	60	00	40	100